

CHAPTER 3: THE AFFECTED ENVIRONMENT

INTRODUCTION

This chapter describes the existing conditions of the physical, biological, cultural, and socioeconomic resources in the study area. The resources that are addressed here were identified during the scoping process or interdisciplinary team review as having the potential to be affected. Figure 3-1 shows the general analysis area for most environmental resources. The analysis area includes the West Hay Creek LBA tract as applied for under the Proposed Action and Alternatives 2 and 3. The analysis area is also located within the current Buckskin Mine permit area. Environmental baseline studies required by WDEQ/LQD for permitting the mining of the Proposed Action and Alternative 3 lands were conducted in 1999 and 2000. Additional baseline studies would have to be completed before the lands added in Alternative 2 could be permitted. Annual monitoring has continued over the analysis area and 1 mile adjacent lands through 2001 and 2002. All baseline studies were reviewed and approved by WDEQ/LQD as part of the Hay Creek amendment. This amendment added the lands Triton obtained through their acquisition of the EOG Resources, Inc. coal lease exchange which was assigned lease number WYW150152.

Critical elements of the human environment (BLM 1988) that could potentially be affected by the proposed actions include air quality, cultural resources, Native American religious concerns, T&E, and candidate species, hazardous or solid wastes, water quality, wetlands/riparian zones, invasive non-native species, and environmental justice. Five other critical elements (areas of critical environmental concern, prime or unique farmlands, flood plains, wild and scenic rivers, and wilderness) are not present in the analysis area and are not addressed further. In addition to the critical elements that are potentially present in the analysis area, the status and potential effects of mining on topography and physiography, geology and mineral resources, soils, water quantity, alluvial valley floors, vegetation, wildlife, land use and recreation, paleontological resources, visual resources, noise, transportation resources, and socioeconomics are discussed.

GENERAL SETTING

The analysis area is adjacent to the northernmost operating mine within the PRB, a part of the Northern Great Plains which includes most of northeastern Wyoming (figure 1-1). Vegetation is primarily big sagebrush and sandy prairie grassland. The climate is semi-arid, with an average annual precipitation at the Buckskin Mine of about 10.5 inches. June (1.94 inches) and May (1.94 inches) are the wettest months, and January and February (0.12 inches) are the driest. Snowfall at the Gillette 9ESE station averages 58 inches per year, with most occurring in March (10.3 inches) and April (8.6 inches) (Western Regional Climate Center 2002). Potential evapotranspiration, at approximately 31 inches (NOAA 1969), exceeds annual precipitation (Martner 1986).

Figure 3-1. General Analysis Area.

The mean of the average hourly temperature recorded at the Buckskin Mine during the 1983-1998 time period is 44.6 F. The highest recorded hourly temperature at the mine was 102 F and the lowest was -40 F. August is the warmest month, with a mean temperature of 69 F, and December is the coldest (23 F). The frost-free period is 100 to 125 days.

The average annual wind speed for the period 1983 through 1998 at the Buckskin Mine (figure 3-5) was 10.3 mph. Wind speeds are highest in the winter and spring and are predominantly from the northwest and south-southeast. Winter gusts often reach 30 to 40 mph. During periods of strong wind, dust may affect air quality across the region.

Air-stagnation events average 15 annually in the PRB with an average duration of two days each (BLM 1974). General information describing the area's resources was gathered from draft BLM Buffalo Field office planning documents (BLM 1996a, 1996b, 1996c, 1996d, 1996g) and a BLM coal leasing study (BLM 1996e).

TOPOGRAPHY AND PHYSIOGRAPHY

The PRB is an elongated, asymmetrical structural downfold. It is bounded by the Casper Arch, Laramie Mountains, and Hartville Uplift to the south; the Miles City Arch in Montana to the north, the Big Horn Mountains on the west, and the Black Hills on the east. The Buckskin Mine is located on the gently dipping eastern limb of the structural basin. The regional dip in the area of the mine is approximately 1° to the northwest. There are local areas where the shallow strata dip at higher angles due to local folding or faulting.

The PRB landscape consists of broad plains, low hills, and tablelands. Generally, the topography changes from open hills and elevated ridges with 500 to 1,000 feet of relief in the northern part of the PRB to plains and tablelands with 300 to 500 feet of relief in the southern part. Playas are common in the basin, as are buttes and plateaus capped by clinker or sandstone. The LBA tract is in an area consisting primarily of elevated ridges broken by minor drainages with an elevation ranging from 4,100 to 4,340 feet.

Hay Creek crosses through the northern portion of the LBA tract, and the entire LBA tract is within the contributory drainage basin of Hay Creek. Hay Creek, which is a minor headwater stream in the regional drainage network of the Little Powder River, flows from west to east through the tract. Its confluence with the Little Powder River is about 3 miles east of the LBA tract.

Overall, the West Hay Creek LBA tract is similar in topography to the Buckskin Mine permit area. Slopes range from flat to about 22% and average about 7%.

GEOLOGY

Stratigraphic units in the mine area that would be impacted if the West Hay Creek LBA tract is mined include, in descending order, recent (Quaternary age) alluvial and eolian deposits, the Eocene age Wasatch Formation (the overburden), and the Paleocene age Fort Union Formation (which contains the targeted Anderson and Canyon coal beds). Surficial deposits in the analysis area include Quaternary alluvial and eolian deposits, Wasatch Formation, clinker, and weathered Wasatch and Fort Union formations. There is some surficial clinker exposed along the northern portion of the LBA tract analysis area, primarily in the SE¼/NE¼ of section 17. There are thin alluvial deposits along the ephemeral stream channel of Hay Creek and other neighboring tributary channels, with deposits restricted to the lower reaches. They typically consist primarily of poorly stratified and poorly sorted, irregularly bedded unconsolidated sand, silt, and fine gravel. (The “Water Resources” section and figure 3-9 contain more information about the Hay Creek alluvial deposits.)

The Wasatch Formation forms most of the overburden on top of the recoverable coal seams in the Fort Union Formation in the general analysis area. It consists of interbedded lenticular sandstones, siltstones, shales, and thin discontinuous coals. There is no distinct boundary between the Wasatch Formation and the underlying Fort Union Formation. From a practical standpoint, however, the top of the mineable coal zone is considered as the contact between the two formations. The average overburden thickness on the LBA tract is about 204 feet. Regionally, overburden thickness generally increases to the west due to the westerly dip of the beds in this area. Overburden thickness decreases in stream valleys where it has been eroded.

The Fort Union Formation consists primarily of shales, mudstones, siltstones, lenticular sandstones, and coal. It is divided into three members: Tongue River (which contains the target coal seams), Lebo, and Tullock, in descending order (figure 3-2).

The Tongue River member consists of interbedded claystone, silty shale, carbonaceous shale and coal, with lesser amounts of fine-grained sandstone and siltstone. At the Buckskin Mine, there are two mineable coal seams. Triton personnel refer to these seams as the Anderson and Canyon. These coal seams are also referred to as the Roland and Smith at the nearby Rawhide and Eagle Butte mines.

Figure 3-3 shows two geologic cross-sections drawn through the West Hay Creek LBA tract (one north-south and one east-west). These cross sections are representative of the geology near the tract, with the primary variables being the thickness of overburden, the parting thickness between the Anderson and Canyon coal seams, and the surface topography. Figure 3-2 is a chart showing the stratigraphic relationships and hydrologic characteristics of the surface and subsurface geologic units in the area of the Buckskin Mine.

Figure 3-2. Stratigraphic Relationships and Hydrologic Characteristics of Upper Cretaceous, Lower Tertiary, and Recent Geologic Units, Powder River Basin, Wyoming. (Compiled from Hodson et al. 1973 and Lewis and Hotchkiss 1981).

Figure 3-3. North-South and East-West Geologic Cross Sections, West Hay Creek LBA Tract.

On the West Hay Creek LBA tract, the Anderson coal seam averages 40 feet thick and the underlying Canyon seam averages 66 feet. The parting thickness between the Anderson and Canyon coal seams averages about 15 feet in the tract. Along the northern edge of the area, especially within the area added under Alternative 2, the parting thickness increases rapidly to about 150 feet as the Anderson seam rises to within 20 feet of the ground surface, and the Canyon seam dips slightly. In the east-west direction, the Canyon seam dips to the west more uniformly than the Anderson; consequently, the parting thickness increases along the western limit of the LBA tract.

In the southern portion of the tract, the parting is much thinner and averages about four feet.

The Fort Union coal seams are subbituminous and are generally low-sulfur, low-ash coals. Typically, the coal being mined has a lower heating value north of Gillette than south of Gillette. According to the analyses (which were done on an as-received basis) of exploration drilling samples collected in the Buckskin Mine area from the adjacent Hay Creek lease, the recoverable coal reserve has an average heating value of approximately 8,140 Btu per pound and contains an average of 5.31% ash, 0.41% sulfur, and 32.09% moisture.

A geologic anomaly known as a splay deposit was encountered at the Buckskin Mine in section 28, T. 52 N., R. 72 W. during 2001. Splay deposits form when the levees of the swamp bounding the river or stream channel are breached, and a portion of the river/stream flow is diverted out into the swamp. This diverted flow usually terminates some distance from the levee. The sediments of the splay sink into the peat bog allowing the repeated deposition of additional splay deposits. These events usually occur during the flood stages of the river system and may be short or long-lived in time. On occasion, a splay course may become the new course of the river system. These splays may either be syngenetic (contemporaneous) or epigenetic (post-depositional) with the peat deposition in the swamp. The geometry of the Buckskin Mine deposit suggests a syngenetic deposit with the Canyon seam. Geologic modeling indicates this feature extends from the NW¼ of section 28 onto the LBA tract in the SW¼ of section 20. Further drilling should better define the limits and characteristics of the splay, particularly within and adjacent to the LBA tract.

The end of the splay is characterized by numerous, narrow fingers of noncoal material interbedded with portions of the coal seam edge resulting in areas of thin or no coal deposition. In the past, this splay has frequently been misidentified as a channel or channel sandstone. Although the deposit is channel-like in appearance and geometry, the terminus features and the typical clay-silt lithology of the splay make it unlike a river/stream channel complex.

The interface edges of the splay deposit are very unstable from a rock mechanics standpoint. Differential compaction along the splay boundary has locally thinned or thickened the coal. Steep dips and slippage features such as slickensides and micro-faults are abundant in these areas. In areas where splay fingers of steep thin coals extend

between thicker coals, sidewall failures might be expected.

The Lebo Shale and Tullock members of the Fort Union Formation underlie the Tongue River member (figure 3-2). They consist primarily of sandstone, siltstone, mudstone, shale and coal. In general, the Tullock member contains more sand than the Lebo Shale member.

Mineral Resources

The PRB contains large reserves of fossil fuels including oil, natural gas or methane (from conventional reservoirs and from coal beds), and coal, all of which are currently being produced. In addition, uranium, bentonite, and scoria are mined in the PRB (BLM 1996g).

Coal. There are 15 coal mines lying along a north/south line that parallels Wyoming Highway 59 starting north of Gillette, Wyoming, and extending south for about 75 miles (figure 1-1). Several of these mines, including the Fort Union and Coal Creek mines, are capable of producing but are not currently active. These mines are located where the Wyodak coal is at its shallowest depths (nearest the outcrop). The Dave Johnston Mine, located near Glenrock, Wyoming has also shut down coal mining operations and is conducting final reclamation.

Oil and Gas. Oil and gas have been produced in the PRB for more than 100 years from reservoir beds that range in age from Pennsylvanian to Oligocene (DeBruin 1996). There are approximately 500 producing oil and/or natural gas fields in the basin. The estimated mean amounts of undiscovered hydrocarbons in the basin are 1.94 billion barrels of recoverable oil and 1.60 trillion cubic feet of gas (USGS 1995). Depth to gas and oil-bearing strata is generally between 4,000 feet and 13,500 feet, but some wells are as shallow as 250 feet.

There are no active conventional oil or gas wells within the LBA tract. One pipeline owned by Western Oil Transportation Company crosses the northwest corner of the tract.

Coal Bed Methane. Methane gas generated from coal beds is a natural process. Methane may be trapped in the coal by overburden pressure, by the pressure of water in the coal, or by impermeable layers immediately above the coal. Deeper coal beds have higher pressures and generally trap more gas. Under favorable geologic conditions, methane can be trapped at shallow depths in and above coal beds, and this seems to be the case in the PRB. Without the existence of conditions that act to trap the gas in shallow coals or in adjacent sandstones, the gas escapes to the atmosphere. It is likely that a lot of methane generated by the coal beds in the PRB has gradually escaped into the atmosphere because the coal is relatively shallow. However, a large amount also remains in the coal. A recent study estimates that there are approximately 38.2 trillion cubic feet of CBM gas in place in coal beds that are thicker than 20 feet and deeper than 200 feet. This study estimates that there are 25.6 trillion cubic feet of recoverable CBM reserves (Finley and Goolsby 2000).

Historically, methane has been reported flowing from shallow water wells and coal exploration holes in parts of the PRB. According to DeBruin and Jones (1989), most of the documented historical occurrences have been in the northern PRB. Olive (1957) references a water well in T. 54 N., R. 74 W. that began producing gas for domestic use in 1916.

CBM has been commercially produced in the Powder River Basin since 1989 when production began at Rawhide Butte field west of the Eagle Butte Mine. Extensive CBM development is occurring on lands underlying, adjacent to, and to the west of the coal mining area. More than 12,000 CBM wells have been drilled or are permitted for drilling. The predominant CBM production to date has occurred from coal beds of the Wyodak-Anderson zone (USGS 2000) in seams known as the Anderson, Canyon, Wyodak, Big George, and other locally used names. These are generally equivalent to the seams being mined by the surface mines along the eastern margin of the basin, including the Buckskin Mine, the applicant for the proposed West Hay Creek LBA tract.

CBM is produced from other, deeper seams locally throughout the PRB. Deeper seams exist in the LBA area, but they are not in production. Leasing or mining the proposed LBA tract, would not directly affect CBM resources production within the underlying seams, but it could delay any proposed CBM development in deeper seams in order to avoid interference with mining.

CBM development requires more extensive facilities in areas where there are splits between the coal seams. In the northern and western part of the West Hay Creek LBA tract, shale interbeds that can be more than 100 feet thick separate the Anderson and Canyon seams. Current CBM well completion technology within the Powder River Basin will not accommodate completion of two seams separated by thick shales within a single wellbore. As a result, in the areas where the parting thickness increases, two wells would be required to produce essentially the same reserve that would be produced from a single well in a single contiguous seam.

Since the early 1990s, the BLM has completed numerous EAs and two EISs analyzing CBM projects. The most recent of these was the *Draft Environmental Impact Statement and Draft Planning Amendment for the Powder River Basin Oil and Gas Project* (BLM 2002). This document analyzed the impacts of drilling, completing and operating about 39,400 new private, state and federal CBM wells and associated ancillary facilities in the next ten years over an almost 8,000,000-acre area covering all or parts of Campbell, Converse, Johnson, and Sheridan counties. The cumulative impacts of reasonably foreseeable conventional oil and gas development within the Wyoming portion of the PRB are also analyzed

The most extensive CBM development near the West Hay Creek LBA area occurs west of the proposed tract. On October 28, 2002, WOGCC records indicated 79 completed CBM wells within T. 52 N., R. 72 W. that were capable of production. Only seven of the wells are

located within the LBA tract itself (as of October 28, 2002). All of these showed some minimal amounts of production, but only four are currently producing.

The WOGCC has established 80-acre spacing patterns as the default spacing for CBM wells in the Powder River Basin. Most CBM drilling near the West Hay Creek LBA has occurred on a 40-acre pattern, presumably under the authorization of spacing exceptions granted by WOGCC. There are 7 remaining undrilled complete or partial 80-acre spacing units on the LBA tract and 15 undrilled 40-acre units. Complete CBM development of the LBA tract would require either 7 or 15 additional wells depending on the development pattern. WOGCC records indicate that, as of October 31, 2002, development is continuing on a general 40-acre pattern and that wells have been proposed on 10 of the remaining undrilled 40-acre spacing units.

The ownership of oil and gas resources in the LBA tract is discussed in “Ownership and Use of Land” section. Majestic Petroleum Operations, LLC, Redstone Resources, and Yates Petroleum Corporation are the owners of most of the CBM drilling rights on the West Hay Creek LBA tract.

Bentonite. Layers of bentonite (decomposed volcanic ash) of varying thickness are present throughout the PRB. Some of the thicker layers are mined where they are near the surface, mostly around the edges of the basin. Bentonite has a large capacity to absorb water, and because of this characteristic it is used in a number of processes and products, including cat litter and drilling mud. No mineable bentonite reserves have been identified on the West Hay Creek LBA tract.

Uranium. There are substantial uranium resources in southwestern Campbell and northwestern Converse counties. Uranium exploration and mining were very active in the 1950s, when numerous claims were filed in the PRB. Uranium mining decreased in the early 1980s due to decreased demand and increased foreign supply. There are currently two *in-situ* leach operations in the PRB. Production at another ended in 2000. No known uranium reserves exist on the West Hay Creek LBA tract.

Scoria. Scoria or clinker has been and continues to be a major source of gravel for road construction in the area. Scoria is present on small portions of the LBA tract as applied for and under Alternatives 2 and 3.

There are no active mining claims on the West Hay Creek LBA tract.

SOILS

The analysis area, which includes the LBA tract, was subjected to two separate order 1-2 soils surveys in 1989 and 1999. The majority of the tract was surveyed in 1999. The area covered in the study includes the LBA tract under the Proposed Action, Alternatives 2 and 3, as well as the area that would be disturbed under the Proposed Action or Alternative 3. Figure 3-4 illustrates the soil series within the analysis area.

Figure 3-4. Soil Series Within the West Hay Creek LBA Tract Analysis Area.

All soil surveys were completed to an order 1-2 resolution in accordance with WDEQ/LQD Guideline No. 1, which outlines required soils information necessary for a coal mining operation. The inventories included field sampling and observations at the requisite number of individual sites, and laboratory analysis of representative collected samples.

The following is a list of the soil series that comprise the various map units delineated on the proposed affected area associated with the West Hay Creek LBA tract under the Proposed Action, including the area added under Alternatives 2 and 3.

Soils developing predominantly in alluvium and residuum from mixed sources

- ! Forkwood-Cushman loams, 0 to 6% slopes
- ! Hiland-Bowbac fine sandy loam, 0 to 6% slopes
- ! Lawver-Teckla-Wibaux complex, moist, 0 to 10% slopes
- ! Spottedhorse-Lieter Complex, 0 to 6% slopes
- ! Theedle-Kishona-Shingle loams, 3 to 30% slopes
- ! Theedle-Shingle loams, 3 to 30% slopes
- ! Ulm-Renohill association, clay loam, 0 to 6% slopes
- ! Vonalf-Xema-Mittenbutte fine sandy loam, 3 to 30% slopes
- ! Rauzi fine sandy loam, 0 to 3% slopes
- ! Ustic Torripsamment, sandy, 0 to 30% slopes

Soils developing predominantly in alluvial or colluvial fan deposits and fan remnants from mixed sources

- ! Cambria-Kishona-Aigweid loams, 6 to 15% slopes
- ! Decolney-Hiland fine sandy loams, 0 to 6% slopes
- ! Heldt-Bidman complex, saline, 0 to 3% slopes
- ! Ironbutte-Fairburn-Mittenbutte complex, 6 to 40% slopes
- ! Platmak loam, 0 to 6 percent and 6 to 15% slopes
- ! Vonalee-Terro-Taluce fine sandy loam, 3 to 30% slopes

Soils developing predominantly in alluvium and eolian deposits derived from mixed sources

- ! Arwite-Elwop sandy loam, 0 to 6 % slopes
- ! Haverdat-Boruff loams, 0 to 6% slopes
- ! Mollic Fluvaquent, hydric, 0 to 1% slopes
- ! Vonalee fine sandy loam, 0 to 6% slopes

Table 3-1 provides the extent of six depth classes of suitable soil within the LBA tract analysis area.

According to the baseline soils studies, enough suitable soil exists for salvaging within the

LBA tract to redistribute suitable soils to an average depth of approximately 15 inches over all disturbed areas. This is true for the Proposed Action and Alternatives 2 and 3. This depth would be redistributed on all disturbed acres. Areas of unsuitable soils include sites with high alkalinity, salinity or clay content.

The soil depths and types on the West Hay Creek LBA tract analysis area are similar to soils currently being salvaged and used for reclamation at the adjacent mine and other mines in the PRB. The site-specific soil surveys have located hydric soils and/or inclusions of hydric soils, which are one component used in identifying wetlands. Please see the "Wetlands" section for discussion of wetland surveys.

**TABLE 3-1
ACRES OF SOIL AVAILABLE FOR RECLAMATION
WITHIN THE WEST HAY CREEK LBA TRACT ANALYSIS AREA**

Suitable Soil Thickness	Acres	Percent
0	19.0	1.6
1 B 6	2.5	0.2
7 B 12	484.8	41.8
13 B 18	533.5	46.0
19 B 24	120.9	10.4
Total	1,160.8	100.0

AIR QUALITY AND CLIMATE

Air quality of any region is controlled primarily by the magnitude and distribution of pollutant emissions and the regional climate. The transport of pollutants from specific source areas is strongly affected by local topography. In the mountainous western United States, topography is particularly important in channeling pollutants along valleys, creating upslope and downslope circulations that may entrain airborne pollutants, and blocking the flow of pollutants toward certain areas. Generally, local effects are superimposed on the general overall weather pattern and are most important when the large-scale wind flow is weak.

Topography

The West Hay Creek LBA tract analysis area (figure 1-1) is located in the PRB, a part of the Northern Great Plains that includes most of northeastern Wyoming. The topography is primarily rolling plains and tablelands of moderate relief (with occasional valleys, canyons and buttes). The LBA tract is in an area consisting primarily of elevated ridges broken by minor drainages with an elevation ranging from 4,100 to 4,340 feet. Slopes in the analysis area range from flat to greater than 22%.

Climate and Meteorology

The climate in the analysis area is semi-arid, with an average annual precipitation at the Buckskin Mine of about 10.5 inches per year. Snowfall at the Gillette 9ESE Station averages 58 inches per year, with most occurring in March and April. Evaporation exceeds annual precipitation, with relatively short warm summers and longer cold winters. The average daily mean temperature is around 45°F. The highest recorded hourly temperature at the mine was 102°F and the lowest was -40°F. August is the warmest month, with a mean daily temperature of 69°F, and December is the coldest (23°F). The frost-free period is 100-125 days.

The average annual wind speed for the period from 1983 through 1998 at the Buckskin Mine was 10.3 mph with local variations in speed and direction due to differences in topography. Winds are predominantly from the northwest and south-southeast and tend to be strongest in the winter and spring and calmer in the summer. Wind velocity tends to increase during the day and decrease during the night. The air quality and meteorological sampling locations and associated wind rose diagrams for the Buckskin Mine are shown in figure 3-5.

Existing Air Quality

WDEQ detects changes in air quality through monitoring and maintains an extensive network of air quality monitors throughout the state. Particulate matter is most commonly measured as particles finer than 10 microns or PM₁₀. The eastern side of the Powder River Basin has one of the most extensive networks of monitors for PM₁₀ in the nation due to the density of coal mines (figure 3-6). In addition, there are also monitors in Sheridan and Gillette, Wyoming, and the WDEQ installed monitors in Arvada and Wright, Wyoming in November 2002.

WDEQ uses monitoring located throughout the state to anticipate issues related to air quality. These monitoring stations are located to measure ambient air quality and not located to measure impacts from a specific source. Monitors located to measure impacts from a specific source may also be used for trends. These data are used to pro-actively arrest or reverse trends towards air quality problems. When WDEQ became aware that particulate readings were increasing due to increased coal bed methane activity and aggravated by prolonged drought, the WDEQ approached the counties, coal mines, and coal bed methane industry. A coalition involving the counties, coal companies and coal bed methane operators have made significant efforts towards minimizing dust from roads. Measures taken have ranged from the implementation of speed limits to paving heavily traveled roads.

Monitoring is also used to measure compliance. The WDEQ can take a range of enforcement actions to remedy the situation where monitoring shows a violation of any

Figure 3-5 Wind Rose, Air Quality, and Meteorological Stations at the Buckskin Mine.

Figure 3-6. Active PM₁₀ Monitoring Stations in Northeastern Wyoming.

standard. Where a standard is exceeded specific to an operation, the enforcement action is specific to the facility. For many facilities, neither the cause nor the solution is simple. The agency normally uses a negotiated settlement in those instances.

WDEQ has also located two visibility monitoring stations in the PRB. One of these sites is 32 miles north of Gillette and includes a nephelometer, a transmissometer, an aerosol monitor (IMPROVE protocol), instruments to measure meteorological parameters (temperature, RH, wind speed, wind direction), a digital camera, instruments to measure ozone, and instruments to measure nitrogen oxides (NO, NO₂, NO_x). The other visibility monitoring station is located 14 miles west of Buffalo and includes a nephelometer, a transmissometer, an aerosol monitor (IMPROVE protocol), instruments to measure meteorological parameters (temperature, RH, wind speed, wind direction), and a digital camera.

Other air quality monitoring in the PRB includes WDEQ NO₂ monitoring along the east side of the PRB, Wyoming air resources monitoring system (WARMS) monitoring of sulfur and nitrogen concentrations near Buffalo, Sheridan, and Newcastle, and National Atmospheric Deposition Program (NADP) monitoring of precipitation chemistry in Newcastle.

Air quality conditions in rural areas are likely to be very good, as characterized by limited air pollution emission sources (few industrial facilities and residential emissions in the relatively small communities and isolated ranches) and good atmospheric dispersion conditions, resulting in relatively low air pollutant concentrations. Occasional high concentrations of carbon monoxide (CO) and particulate matter may occur in more urbanized areas (for example, Buffalo, Gillette, and Sheridan) and around industrial facilities, especially under stable atmospheric conditions common during winter.

As part of an analysis of air quality impacts that was conducted to analyze potential air quality impacts from the oil and gas development alternatives being considered in the Wyoming *Final Environmental Impact Statement and Proposed Plan Amendment for the Powder River Basin Oil and Gas Project* (BLM 2003a) and the Montana *Final Statewide Environmental Impact Statement and Proposed Amendment of the Powder River and Billings Resource Management Plans* (BLM 2003b), monitoring data measured throughout northeastern Wyoming and southeastern Montana were assembled and reviewed. Although monitoring is primarily conducted in urban or industrial areas, the data selected are considered the best available representation of background air pollutant concentrations throughout the PRB in Wyoming and Montana. Specific values are presented in table 3-2 along with applicable ambient air quality standards and prevention of significant deterioration (PSD) increments. These values were used to define background conditions in the air quality impact analysis. The assumed background pollutant concentrations are below applicable NAAQS and WAAQS for all criteria pollutants and averaging times.

TABLE 3-2
ASSUMED BACKGROUND AIR POLLUTANT CONCENTRATIONS,
APPLICABLE AMBIENT AIR QUALITY STANDARDS, AND PSD INCREMENT VALUES
(in µg/m³)

Pollutant	Averaging Time ¹	Background Concentration	Primary NAAQS ²	Secondary NAAQS ²	Wyoming Standards	PSD Class I Increments	PSD Class II Increments
Carbon monoxide	1-hour	3,500 ³	40,000	40,000	40,000	-----	-----
	8-hour	1,500	10,000	10,000	10,000	-----	-----
Nitrogen dioxide	Annual	16.5 ⁴	100	100	100	2.5	25
Ozone	1-hour	82 ⁵	235	235	235	-----	-----
	8-hour	130 ⁵	157	157	157	-----	-----
PM ₁₀	24-hour	42 ⁷	150	150	150	8	30
	Annual	17 ⁷	50	50	50	4	17
PM _{2.5}	24-hour	19 ⁷	65	65	65	-----	-----
	Annual	7.6 ⁷	15	15	15	-----	-----
Sulfur dioxide	3-hour	8 ⁶	-----	1,300	1,300	25	512
	24-hour	8 ⁶	365	-----	260	5	91
	Annual	3 ⁶	80	-----	60	2	20

- ¹Annual standards are not to be exceeded; short-term standards are not to be exceeded more than once per year.
²Primary standards are designed to protect public health; secondary standards are designed to protect public welfare.
³Amoco Ryckman Creek collected for an 8-month period during 1978-1979, summarized in the Riley Ridge EIS (BLM 1983).
⁴Data collected in Gillette, WY (1996-1997).
⁵Data collected in Pinedale, WY (1992-1994).
⁶Data collected at Devil's Tower, WY (1983).
⁷Data collected in Gillette, WY (1999).

Source: Argonne 2002

The major types of emissions that come from surface coal mining activities are in the form of fugitive dust and tailpipe emissions from large mining equipment. Activities such as blasting, loading and hauling of overburden and coal and the large areas of disturbed land all produce fugitive dust. Stationary or point sources are associated with coal crushing, storage, and handling facilities. In general, particulate matter (PM₁₀) is the major significant pollutant from coal mine point sources.

Blasting is responsible for another type of emission from surface coal mining. Overburden blasting sometimes produces gaseous orange-colored clouds that contain NO₂. Exposure to NO₂ may have adverse health effects, which are discussed in chapter 4. NO₂ is one of several products resulting from the incomplete combustion of explosives used in the blasting process. Wyoming's ambient air standards for NO₂ are shown in table 3-2. Other existing air pollutant emission sources within the region include:

- Exhaust emissions (primarily CO and oxides of nitrogen [NO_x]) from existing natural gas fired compressor engines used in production of natural gas and coal bed methane; gasoline and diesel vehicle tailpipe emissions of combustion pollutants (volatile organic compounds [VOC], CO, NO_x, inhalable particulate matter less than 10 microns in effective diameter [PM₁₀], fine particulate matter less than 2.5 microns in effective diameter [PM_{2.5}], and sulfur dioxide [SO₂]);
- Dust (particulate matter) generated by vehicle travel on unpaved roads, windblown dust from neighboring areas and road sanding during the winter months;
- Transport of air pollutants from emission sources located outside the region;
- Emissions from railroad locomotives used to haul coal (primarily NO₂ and PM₁₀); and,
- SO₂ and NO_x from power plants.

Historical Ambient Air Quality: Particulates

Until 1989, the federally regulated particulate matter pollutant was measured as TSP. This measurement included all suspendable dust (generally less than 100 microns in diameter).

In 1989, the federally regulated particulate matter pollutant was changed from a TSP based standard to a PM₁₀ based standard. PM₁₀ is particulate matter with an aerodynamic diameter of 10 microns or less that can potentially penetrate into the lungs and cause health problems. Wyoming added PM₁₀ based standards to match the federal standards in 1989 and retained the TSP based standards as state standards until March 2000. Wyoming's ambient air standards for PM₁₀ are shown in table 3-2.

Regional. WDEQ/AQD requires the collection of information documenting the quality of the air resource at each of the PRB mines. Each mine monitored air quality for a 24-hour period every six days at multiple monitoring sites through the end of 2001. All PM₁₀ monitors are now required by WDEQ/AQD to sample air quality for a 24-hour period every three days beginning in 2002. Data for TSP dates back to 1980; data for PM₁₀ dating back to 1989. This has resulted in nearly 52,000 TSP and 8,000 PM₁₀ samples collected through 2000 and makes the eastern PRB one of the most densely monitored areas in the world (figure 3-6). Table 3-3 uses the annual arithmetic average of all sites to summarize these data.

As indicated in table 3-3, the long-term trend in particulate emissions remained relatively flat through 1998. TSP concentration from 1980 through 1998 averaged 33.1 $\mu\text{g}/\text{m}^3$, ranging between 27.8 $\mu\text{g}/\text{m}^3$ and 39.4 $\mu\text{g}/\text{m}^3$. There were increases in 1988 and 1996, which may have been the result of fires in the region during those years. PM₁₀ concentration from 1989 through 1998 averaged 15.4 $\mu\text{g}/\text{m}^3$, ranging between 12.9 and 16.5 $\mu\text{g}/\text{m}^3$.

This period (1980-1998) was associated with significant growth in the surface coal mining industry. Coal production increased from about 59 mmtpy to over 308 mmtpy (an increase of over 249 mmtpy), and associated overburden production increased from 105 mmby to over 710 mmby per year (a 605 mmby per year increase). From 1990 through 2000, the average annual increase in coal production was 7.4%, while annual overburden production increased an average of 14.6% over the same period. The larger annual increase in overburden production is probably because mines are gradually moving into deeper coals as the shallower reserves are mined out.

The relatively flat trend in particulate emissions from 1980 through 1998 is due in large part to the Wyoming Air Quality Program that requires the best available control technology (BACT) at all permitted facilities. BACT control measures include watering and chemical treatment of roads, limiting the amount of area disturbed, temporary revegetation of disturbed areas to reduce wind erosion, and timely final reclamation.

Concentrations increased from 33.9 $\mu\text{g}/\text{m}^3$ in 1998 to 55.3 $\mu\text{g}/\text{m}^3$ in 1999 and continued to increase at a slightly slower pace in 2000. There were no major fires in the region during this time. The increases in coal production over those two years (2.3% per year and 13.9 mmtpy over the two-year period) and associated overburden production (9.5% per year and 135 mmby over the two-year period) were not larger than the two-year increases during some of the previous 18 years, but the particulate concentration increase was much larger than in previous years.

TABLE 3-3
SUMMARY OF AIR QUALITY MONITORING
IN WYOMING'S POWDER RIVER BASIN, 1980-2000

Year	Coal Produced (mmtpy)	Yards Moved (mmbcy)	Number of Mines Operating/ Monitoring TSP/ Monitoring PM ₁₀ ¹	Number of Sites TSP/PM ₁₀ ² (µg/m ³)	TSP Average (µg/m ³)	PM ₁₀ Average (µg/m ³)
1980	58.7	105.3	10/14/0	34/0	35.5	na ³
1981	71.0	133.4	11/13/0	35/0	39.4	na
1982	76.1	141.1	11/14/0	40/0	31.2	na
1983	84.9	150.9	13/14/1	41/1	32.6	11.2
1984	105.3	169.5	14/16/1	42/1	33.9	11.1
1985	113.0	203.4	16/17/0	49/0	32.3	na
1986	111.2	165.7	16/17/0	45/0	29.3	na
1987	120.7	174.6	16/17/0	43/0	31.7	na
1988	138.8	209.7	16/17/0	43/0	37.7	na
1989	147.5	215.6	15/17/3	40/3	32.1	15.9
1990	160.7	223.5	17/17/5	47/5	34.3	14.8
1991	171.4	245.9	17/17/5	46/6	32.7	16.5
1992	166.1	296.0	17/17/7	41/7	31.7	15.9
1993	188.8	389.5	17/17/8	40/11	27.8	14.5
1994	213.6	483.9	17/18/8	44/11	31.7	15.5
1995	242.6	512.7	16/18/8	41/12	29.6	12.9
1996	257.0	605.4	17/18/8	41/12	35.4	16.0
1997	259.7	622.0	16/17/10	39/15	33.3	15.9
1998	308.6	710.7	16/17/12	36/17	33.9	15.9
1999	317.1	758.0	15/17/12	36/18	55.3	21.6
2000	322.5	845.3	15/15/12	31/17	56.1	23.4

¹Includes Buckskin, Rawhide, Eagle Butte, Dry Fork, Fort Union, Clovis Point, Wyodak, Caballo, Belle Ayr, Caballo Rojo, Cordero, Coal Creek, Jacobs Ranch, Black Thunder, North Rochelle, North Antelope, Rochelle, and Antelope.

²Some sites include more than one sampler, so the number of samplers is greater than the number of sites.

³Not applicable because no monitoring was done for PM₁₀.

Sources: 1980 through 1996 emissions and production data from April 1997 report prepared by WMA for WDEQ/AQD; 1997 through 2000 emissions data from EPA AIRData database, and production data from WDEQ/AQD.

Site Specific. For the Buckskin Mine monitoring locations, historical particulate matter ambient air quality data generally show the same results as described above for the PRB as a whole. TSP and monitoring locations are shown on figure 3-5. Figure 3-7 presents the average annual TSP and PM₁₀ measured at sites within the West Hay Creek LBA analysis area. These data were collected for 1995 through 2001. Cumulative coal and overburden production for the Buckskin Mine for these years are also shown on figure 3-7.

As discussed above, TSP was the federally regulated pollutant until 1989 and was retained as a state regulated pollutant until 2000. PM₁₀ became a federal standard in 1989 and was adopted by the state of Wyoming. There were no violations of the TSP standard at the Buckskin Mine when TSP was the federally regulated pollutant. After 1989 and until recently, TSP measurements were used as a surrogate for PM₁₀ in lieu of having to replace and/or co-locate an existing TSP sampler with a new PM₁₀ sampler. There were no violations of the PM₁₀ standards anywhere in the PRB through the first quarter of 2001. In 2001 and 2002 the 24-hour PM₁₀ standard was exceeded several times in the southern portion of the Powder River Basin (specific monitoring data are presented in the appendix E). The WDEQ/AQD is continually reviewing the data and considering regulatory options. Particulate emissions from nonmining sources have not been quantified; however, more intense monitoring and regulatory inspections have been implemented at all PRB coal mines. In addition, the proximity of the monitors where the standard was exceeded to unpaved county roads has resulted in county/industry partnerships to treat portions of these roads with chemical dust suppressants.

Control Measures. Control of particulate emissions at the southern PRB mines is accomplished with a variety of measures. Emissions at coal crushing, storage, and handling facilities (point sources) are controlled with baghouse dust collection systems, passive enclosure control systems (PECs), or atomizers/foggers. These are all considered BACT controls by WDEQ/AQD.

Fugitive emissions are also controlled with a variety of measures that the agency considers BACT. Typically, mine access roads have been paved and water trucks are used to apply water and chemical dust suppressants on all haul roads used by trucks and/or scrapers. Haul truck speed limits are imposed to further help to reduce fugitive emissions from roads. Material drop heights for shovels and draglines (bucket to truck bed or backfill) are limited to the minimum necessary to conduct the mining operations. Timely permanent and temporary revegetation of disturbed areas is used to minimize wind erosion. Fugitive emissions from the coal truck dumps are controlled with stilling sheds. Some of the mines have participated in the control of fugitive emissions from some nearby unpaved county roads by applying dust suppressants. All of these control measures are employed at the Buckskin Mine.

Figure 3-7. Coal Production and Overburden Removal vs. Ambient Particulates for Buckskin Mine.

Historical Ambient Air Quality: NO₂

Regional. NO₂ was monitored from 1975 through 1983 in Gillette and from March 1996 through April 1997 at four locations in the PRB. Table 3-4 summarizes the results of that monitoring. Beginning in 2001 the coal industry in cooperation with WDEQ/AQD installed a network of NO₂ monitors in the PRB. The 2001 data from this regional network are summarized in table 3-5.

TABLE 3-4
ANNUAL AMBIENT NO₂ CONCENTRATION DATA

Site	Gillette	Black Thunder Mine	Belle Ayr Mine	Bill
Year	Percent of Standard ¹	Percent of Standard ¹	Percent of Standard ¹	Percent of Standard ¹
1975	6			
1976	4			1
1977	4			5
1978	11			
1979	11			
1980	12			
1981	14			
1982	11			
1983 ²	17			
1996 ³	16	16	22	22

¹Based on arithmetic averaging of data.

²Monitoring discontinued December 1983, reactivated March 1996 to April 1997.

³Arithmetic average - actual sampling ran from March 1996 to April 1997.

*Inadequate number of samples for a valid annual average.

Source: McVehil-Monnett 1997

Annual NO₂ levels measured in the March 1996 to April 1997 timeframe were below applicable standards. The highest reading was 22 µg/m³ as compared to the 100 µg/m³ standard. All 2001 annual mean NO₂ concentrations are well below the standards of 100 µg/m³.

Site Specific. As discussed above, NO₂ monitoring results are available from several sites in the PRB. The Gillette monitoring site is located approximately 12 miles south of the West Hay Creek LBA tract, the Belle Ayr Mine site is located approximately 24 miles south, the Black Thunder Mine site is located approximately 53 miles south, and the Bill site is located approximately 73 miles south.

**TABLE 3-5
2001 ANNUAL AMBIENT NO₂ CONCENTRATION DATA**

Monitor	Annual Mean NO ₂ Concentration (µg/m ³)
Antelope Mine	7
Belle Ayr Mine	14
Black Thunder Mine	5*
* Data for the 3 rd quarter is questionable; therefore, it was not used in determining the annual mean for the site.	

Control Measures. Some of the mines in the PRB have implemented programs designed to control/limit public exposure to the intermittent, short-term NO₂ releases associated with blasting. All mines comply with the blasting plan publication and notification requirements associated with the permits to mine issued by WDEQ/LQD.

Voluntary measures that have been instituted by some mines include:

- phone notification of neighbors and workers in the general area of the mine prior to large blasts;
- monitoring of weather and atmospheric conditions prior to the decision to detonate a large blast;
- minimizing blast size to the extent possible; and
- posting of signs on major public roads that enter the general mine area and on all locked gates accessing the active mine area.

To date, there have not been any reported events of public exposure to blasting clouds at the Buckskin Mine. Buckskin has voluntarily committed to limiting the size of individual shots to control emissions. The WDEQ has not required any specific measures to control or limit public exposure to NO₂ from blasting.

Air Quality Related Values - Visibility and Acidification of Lakes

Air quality related values (AQRVs), including the potential air pollutant effects on visibility and the acidification of lakes and streams, are applied to PSD Class I and sensitive Class II areas. The land management agency responsible for the Class I area sets a level of acceptable change (LAC) for each AQRV. The AQRVs reflect the land management agency's policy and are not legally enforceable standards.

Visibility. Potential impacts to visibility were considered at 29 PSD Class I and sensitive Class II areas near the PRB. Table 3-6 shows the nearest distances from the sensitive receptor areas to the West Hay Creek LBA tract analysis area.

Visibility can be defined as the distance one can see and the ability to perceive color, contrast, and detail. Fine particulate matter ($PM_{2.5}$) is the main cause of visibility impairment. Visual range, one of several ways to express visibility, is the furthest distance a person can see a landscape feature. Maximum visual range in the western United States would be about 140 miles. Presently, the visibility conditions monitored in the Bridger Wilderness Area are among the best in the United States. Visual range monitoring in the Bridger Wilderness Area shows that one can see more than 70 miles 70% of the time.

Visibility impairment is expressed in terms of deciview (dv). The dv index was developed as a linear perceived visual change (Pitchford and Malm 1994) and is the unit of measure used in the EPA's Regional Haze Rule to achieve the national visibility goal. A change in visibility of 1.0 dv represents a "just noticeable change" by an average person under most circumstances. Increasing dv values represent proportionately larger perceived visibility impairment. Figure 3-8 shows annual averages for the 20% best, worst and middle visibility days at Badlands and Bridger Wilderness Areas from 1988 to 1998, respectively (IMPROVE 2002)¹

Acidification of Lakes. The acidification of lakes and streams is caused by atmospheric deposition of pollutants (acid rain). Lake acidification is expressed as the change in acid neutralizing capacity (ANC) measured in microequivalents per liter ($\mu\text{eq/l}$), the lake's capacity to resist acidification from acid rain. Table 3-7 shows the existing ANC monitored in some mountain lakes

¹ Summaries are based on IMPROVE aerosol data using procedures from the EPA *Draft Guidance for Tracking Progress under the Regional Haze Rule*.

TABLE 3-6
APPROXIMATE DISTANCES AND DIRECTIONS FROM THE WEST HAY CREEK
ANALYSIS AREA TO PSD CLASS I AND CLASS II SENSITIVE RECEPTOR AREAS

Receptor Area	Distance (miles)	Direction to Receptor
Mandatory Federal PSD Class I		
Badlands Wilderness Area ¹	160	SE
Bridger Wilderness Area	215	SW
Fitzpatrick Wilderness Areas	205	SW
Gates of the Mountains Wilderness Area	350	NW
Grand Teton National Park	260	SW
North Absaroka Wilderness Area	205	NW
Red Rock Lakes Wilderness Area	255	W
Scapegoat Wilderness Area	320	NW
Teton Wilderness Area	210	W
Theodore Roosevelt National Park (North Unit)	235	NE
Theodore Roosevelt National Park (South Unit)	210	NE
U. L Bend Wilderness Area	195	NW
Washakie Wilderness Area	180	SW
Wind Cave National Park	115	SE
Yellowstone National Park	210	W
Tribal Federal PSD Class I		
Fort Peck Indian Reservation	215	N
Northern Cheyenne Indian Reservation	70	NW
Federal PSD Class II		
Absaroka-Beartooth Wilderness Area	190	NW
Agate Fossil Beds National Monument	160	SE
Bighorn Canyon National Recreation Area	135	NW
Black Elk Wilderness Area	105	SE
Cloud Peak Wilderness Area	75	W
Crow Indian Reservation	70	NW
Devils Tower National Monument	40	NE
Fort Belknap Indian Reservation	240	NW
Fort Laramie National Historic Site	160	SE
Jewel Cave National Monument	100	SE
Mount Rushmore National Memorial	110	E
Popo Agie Wilderness Area	205	SW
Soldier Creek Wilderness Area	160	SE
¹ Congress designated the wilderness area portion of the Badlands National Park as a mandatory federal PSA Class I area. The remainder of the national park is a PSD Class II area.		

TABLE 3-7
EXISTING ACID NEUTRALIZING CAPACITY IN SENSITIVE LAKES

Wilderness Area	Lake	Background ANC ($\mu\text{eq/L}$)
Bridger	Black Joe	69.0
	Deep	61.0
	Hobbs	68.0
	Upper Frozen	5.8 ¹
Cloud Peak	Emerald	55.3
	Florence	32.7
Fitzpatrick	Ross	61.4
Popo Agie	Lower Saddlebag	55.5

Regulatory Framework

The potential impacts of leasing the West Hay Creek LBA tract must be evaluated with respect to two programs, NAAQS and PSD, as applicable.

The NAAQS set nationwide thresholds for maximum acceptable concentrations of various pollutants. The WAAQS must be at least as stringent as NAAQS. Selected Wyoming and NAAQS ambient air standards are shown in table 3-2. The NAAQS and WAAQS set the absolute upper limits for specific air pollutant concentrations at all locations where the public has access. Existing air quality throughout most of the PRB in Wyoming is in attainment with all ambient air quality standards, as demonstrated by the relatively low concentration levels presented in table 3-2. However, the Sheridan, Wyoming area has been designated as a federal non-attainment area (PM₁₀-moderate) where the applicable standards have been violated in the past. EPA Region 8 staff are concerned that PM₁₀ monitoring data collected near and south of Gillette, Wyoming, have also exceeded both the NAAQS and the available PSD Class II increment. Specific monitoring data are presented in appendix E (EPA 2002). The analysis of the Proposed Alternative must demonstrate continued compliance with all applicable local, state, tribal, and federal air quality standards.

Future development projects that have the potential to emit more than 250 tons per year of any criteria pollutant (or certain listed sources that have the potential to emit more than 100 tons per year) would be required to undergo a regulatory PSD increment consumption analysis under the federal New Source Review permitting regulations. Development projects subject to the PSD regulations must also demonstrate the use of BACT and show that the combined impacts of all PSD sources will not exceed the allowable incremental air quality impacts for NO₂, PM₁₀, or SO₂. A regulatory PSD increment consumption analysis may be conducted as part of a New Source Review, or

Figure 3-8. Visibility in the Badlands and Bridger Teton Wilderness Areas.

independently. The determination of PSD increment consumption is a legal responsibility of the applicable air quality regulatory agencies, with EPA oversight. Finally, an analysis of cumulative impacts due to all existing sources and the permit applicant's sources is also required during PSD analysis to demonstrate that applicable ambient air quality standards will be complied with during the operational lifetime of the permit applicant's operations. In addition, sources subject to PSD permitting requirements would provide specific analysis of potential impairment of AQRVs such as visibility and acid rain.

The CAA also provides specific visibility protection of mandatory federal Class I areas. Mandatory federal Class I areas were designated by the Congress on August 7, 1977 and include wilderness areas greater than 5,000 acres in size and national parks greater than 6,000 acres in size. The mandatory federal Class I areas located nearest to the analysis area are listed in table 3-6. In addition, the Northern Cheyenne Tribe (located northwest of the West Hay Creek LBA tract in Montana) has designated their lands as PSD Class I. As shown in table 3-2, the allowable incremental impacts for NO₂, PM₁₀, and SO₂ within these PSD Class I areas are very limited. Most of the PRB in Wyoming, including the analysis area, is designated as PSD Class II with less stringent requirements.

This NEPA analysis compares potential air quality impacts from the Proposed Action and alternatives to applicable ambient air quality standards, PSD increments, and AQRVs (such as visibility), but it does not represent a regulatory PSD analysis. Comparisons to the PSD Class I and II increments are intended to evaluate a threshold of concern for potentially significant adverse impacts, and do not represent a regulatory PSD increment consumption analysis. Even though the development activities would occur within areas designated PSD Class II, the potential impacts are not allowed to cause incremental effects greater than the stringent Class I thresholds to occur inside any distant PSD Class I area. Finally, the CAA directs the EPA to promulgate the Tribal Authority Rule, establishing tribal jurisdiction over air emission sources within the exterior boundaries of tribal lands. Pursuant to this rule, the Crow and Northern Cheyenne tribes north of the analysis area in Montana may request that they be treated in the same manner as a state (including Section 105 grants and formal recognition as an affected "state" when emission sources are located within 50 miles of tribal lands) under the CAA.

Coal mining in the analysis area is not currently affected by the PSD regulations for two reasons: a) surface coal mines are not on the EPA list of 28 major emitting facilities for PSD regulation, and b) point-source emissions from individual mines do not exceed the PSD emissions threshold of 250 tons per year.

The WDEQ/AQD administers a permitting program to assist the agency in managing the state's air resources. Under this program, anyone planning to construct, modify, or use a facility capable of emitting designated pollutants into the atmosphere must obtain an air quality permit to construct. Coal mines fall into this category.

In order to obtain a construction permit, an operator may be required to demonstrate that the proposed activities will not increase air pollutant levels above annual standards

established by the Wyoming air quality standards and regulations (WDEQ/AQD 2000). The operator will also be required to use BACT for minimizing emissions from the facility. Monitoring may be required as a condition of the permit to construct. A permit to operate will also be required and will contain specific emission limitations and other measures of performance for operation of the facility.

The demonstration required for a construction permit often entails development of an emission inventory for the proposed facility, an estimate of the emissions from all other permitted sources of air pollutants in the vicinity, and the collection of local ambient air quality and meteorology data. This information is used in dispersion modeling to predict the cumulative impact of the proposed facility along with existing sources on the quality of the air in the immediate vicinity, including the impact on any special resource areas.

WATER RESOURCES

Groundwater

Within the West Hay Creek LBA tract there are three water-bearing geologic units that could be disturbed by mining. In descending order, these units are the alluvium, Wasatch Formation overburden, and the Wyodak coal seam or its local equivalent, which in this case would be the Anderson and Canyon coal seams. The subcoal Fort Union Formation is used for water supply at the Buckskin Mine but will not be physically disturbed by mining activities. Figure 3-3 shows the stratigraphic units beneath the West Hay Creek LBA tract and the hydrologic properties.

Triton has completed 22 monitoring wells within the West Hay Creek tract analysis area, most in 1999. Six of these are in the alluvium of Hay Creek, six are in Anderson Coal, four are in Canyon Coal, and six are in the Wasatch Formation overburden. The location of these monitoring wells is shown on figure 3-9. Data from these wells, as well as previously collected data at the Buckskin Mine, were used to prepare the following description of baseline groundwater conditions within the LBA tract analysis area.

Recent Alluvium. Within the West Hay Creek LBA tract, the surface drainages are generally dry draws and the alluvium, colluvium, and slope wash deposits associated with these draws are generally thin. In addition, these unconsolidated deposits are typically of limited lateral extent precluding any significant storage and movement of groundwater. The texture of the alluvium becomes coarser with depth.

Figure 3-9. Monitoring Well Locations Within and Near the West Hay Creek LBA Tract and Fort Union Formation Water Supply Well Locations at the Buckskin Mine.

Wasatch Formation. Within the PRB the Wasatch Formation consists of interbedded sandstones, siltstones and shale with occasional discontinuous coal stringers and clinker deposits, and this description basically holds true for the LBA tract. Saturated strata within the Wasatch are limited in areal extent and are typically thin, lenticular sandstones. The hydraulic connection between sandstone lenses is tenuous due to intervening shale aquitards; thus, groundwater movement through the Wasatch Formation overburden is limited. The sandstone and thin coal stringers, where saturated, will yield water to wells, and this water is largely used for stock watering. Because the saturated sandstone and coal units within the Wasatch Formation are not continuous, the Wasatch is not considered a regional aquifer.

Another geologic unit which may be considered a part of the Wasatch Formation is scoria, also called clinker or burn. It consists of Wasatch sediments that overlaid the coal at one time in the past before the coal burned naturally. These sediments were baked, fused and melted in place, then collapsed into the void left by the burned coal.

Scoria deposits can be a very permeable aquifer and can extend laterally for miles in the eastern PRB. Scoria deposits occur along the northern boundary of the LBA tract under the Proposed Action and therefore occur within the Alternative 2 and Alternative 3 tracts. The hydrologic function of scoria in the general area is to provide infiltration of precipitation and recharge to laterally contiguous overburden and Wyodak coal.

Recharge to the Wasatch Formation is from the infiltration of precipitation and lateral movement of water from adjacent clinker bodies. Regionally, groundwater is discharged from the Wasatch Formation by evaporation and transpiration, by pumping wells, and by seepage into the alluvium along stream drainages. For the Wasatch Formation as a whole, the discontinuous nature of the water bearing units results in low overall hydraulic conductivity and low groundwater flow rates. Because of the varied nature of the aquifer units within the Wasatch, hydraulic properties are variable as well. Martin, et al. (1988) reported that hydraulic conductivities within the Wasatch ranged from 10^4 feet per day to 10^2 feet per day and the geometric mean hydraulic conductivity based on 203 tests was 0.2 feet per day. The geometric mean hydraulic conductivity from 70 aquifer tests using wells completed in sandstone in the Wasatch overburden was 0.35 feet per day, while that from 63 aquifer tests completed in siltstone and claystone in the Wasatch overburden was 0.007 feet per day (Rehm et al. 1980). Aquifer tests from Wasatch overburden within and adjacent to the West Hay Creek present an aquifer hydraulic conductivity range of 0.04 feet per day to 13 feet per day, depending primarily on the presence and amounts of shallow sands within the low-permeability silts and clays that make up the majority of the overburden (Appendix D6, Buckskin Mine WDEQ/LQD permit).

Water quality in the Wasatch Formation is generally poor, with TDS concentrations ranging from approximately 1,800 mg/L to 3,400 mg/L near the LBA tract. Groundwater from the Wasatch Formation is predominantly a calcium and magnesium sulfate type within the Buckskin Mine area and the West Hay Creek LBA tract.

Wyodak Coal. Due to its continuity, the Wyodak coal seam is considered a regional aquifer within the PRB. Within the West Hay Creek LBA tract, the Wyodak coal contains a parting, which divides the seam into two separate mineable seams (the Anderson and Canyon). Despite the occurrence of separate seams, the Wyodak coal is considered a single aquifer in the general analysis area.

Hydraulic conductivity within the Wyodak coal seam is highly variable and is reflective of the amount of fracturing the coal has undergone, as unfractured coal is virtually impermeable. The yield of groundwater to wells and mine pits is smallest where the permeability of the coal is derived primarily from localized unloading fractures. These fractures, which are the most common, were created by the expansion of the coal as the weight of overlying sediments was slowly removed by erosion. The highest permeability is imparted to the coal by tectonic fractures. These are through-going fractures of areal importance created during deformation of the Powder River structural basin. The presence of these fractures can be recognized by their linear expression at the ground surface, controlling the orientation of stream drainages and topographic depressions. Due to their pronounced surface expression, these tectonic fractures are often referred to as lineaments. Coal permeability along lineaments can be increased by orders of magnitude over that in the coal fractured by unloading only.

Aquifer tests conducted in the monitoring wells completed in the Anderson and Canyon seams within and adjacent to the West Hay Creek LBA tract. Coal aquifer hydraulic conductivity measured within and adjacent to the LBA tract at the Buckskin Mine ranges from 0.13 to 950 feet per day (Appendix D6, Buckskin Mine WDEQ/LQD permit). The USGS reports an average coal aquifer hydraulic conductivity of 0.8 feet per day for the general area (Martin et al. 1988).

The chemistry of groundwater in the coal within the adjacent Buckskin Mine and the West Hay Creek LBA tract is variable. Quality is similar between the Anderson and Canyon seams. In general, it is a calcium sulfate type with relatively high TDS concentrations (1,000 to 3,900 mg/L) although sodium bicarbonate type samples have also been identified. Calcium, magnesium and sulfate-rich Anderson coal groundwater within the LBA tract and adjacent areas is found to be uncharacteristic of the sodium bicarbonate dominated groundwater from the same unit within Buckskin Mine's historic permit area. Some groundwater influence to both coal units by overlying overburden aquifers occurs east of the proposed LBA tract near overburden and scoria contacts where both seams are shallow. In two wells in the Canyon seam within the LBA tract, TDS concentrations are less than 1,500 mg/L; low relative to typical overburden units.

Prior to mining, the direction of groundwater flow within the coal aquifer was generally from recharge areas near the outcrop and burn zone into the basin, following the dip of the coal. Site-specific water-level data collected by Triton near the LBA tract and presented in the GAGMO 20-year report (Hydro Engineering 2001) indicate that the groundwater flow directions have been influenced by mining and CBM activities. Groundwater flow within the coal aquifer near the LBA tract is now to the west and southwest.

Subcoal Fort Union Formation. The subcoal Fort Union Formation can be divided into three hydrologic units: the Tongue River aquifer, the Lebo Member, and the Tullock aquifer (Law 1976). The hydrologic units below the Wyodak coal are not directly disturbed by mining, but many mines use them for water supply wells. In a few cases there have been drawdowns in the subcoal aquifer due to leakage into mine pits, dewatering, and CBM development. The Tongue River aquifer consists of lenticular fine-grained shale and sandstone. The Lebo Member, also referred to as the Lebo Confining Layer, is typically more fine-grained than the other two members and generally retards the movement of water (Lewis and Hotchkiss 1981). The Tullock aquifer consists of discontinuous lenses of sandstone separated by interbedded shale and siltstone. Transmissivity is the product of an aquifer's hydraulic conductivity or permeability times its thickness. It is commonly used when discussing the hydraulic properties of the Fort Union Formation, where wells are completed by exposing many discrete sand lenses to the well bore.

Transmissivities are generally higher in the deeper Tullock aquifer than in the Tongue River or Lebo, and many mines in the PRB have water-supply wells completed in this interval (Martin et al. 1988). The average transmissivity for this member as reported by OSM (1984) is 290 square feet per day.

Triton has completed two wells in the subcoal Fort Union Formation to supply water to the Buckskin Mine. The wells range in depth from 1,362 to 1,510 feet. Figure 3-9 shows the Buckskin Mine supply wells, designated as Everclear-1 and Everclear-2. A search of groundwater rights was conducted using Wyoming State Engineer's Office (SEO) records for the West Hay Creek LBA tract analysis area. This search identified a total of 625 permitted groundwater rights within 3 miles of the tract, of which 267 wells are owned by coal mining companies. The remaining 358 wells are presented in appendix F. The SEO data does not record the water-producing formation but typically does record the well depth. Of the 625 wells identified, only 6 wells had completion depths in excess of 1,000 feet. Wells of this completion depth could conceivably be producing from the Tullock Member of the Fort Union Formation.

The water quality of the Fort Union Formation is generally good. Water from this aquifer is typically of the sodium bicarbonate type.

Lance and Fox Hills Formations. Underlying the Fort Union Formation is the Lance Formation of Cretaceous age. At the base of the Lance Formation is the Fox Hills Sandstone. The Lance and Fox Hills formations are not used at the Buckskin Mine.

Surface Water

Overall, the West Hay Creek LBA tract is similar in topography to the Buckskin Mine permit area. Slopes range from flat to about 22%. The area surrounding the West Hay Creek LBA tract consists of gently rolling topography. In general, the streams within this area are typical for the region, and their flow events are closely reflective of precipitation patterns.

Flow events frequently result from snowmelt during the late winter and early spring. Although peak discharges from such events are generally small, the duration and therefore percentage of annual runoff volume can be considerable. During the spring, storms (both rain and snow) increase soil moisture, hence decreasing infiltration capacity, and subsequent rainstorms can result in both large runoff volumes and high peak discharges. The surface water quality varies with streamflow rate; the higher the flow rate, the lower the TDS concentration but the higher the suspended solids concentration. Surface water features within and adjacent to the West Hay Creek LBA tract are displayed in figure 3-10.

The only named stream within the LBA tract is Hay Creek, which flows from west to east through the LBA tract and joins the Little Powder River about 3 miles east of the LBA tract. Hay Creek is a minor headwater stream in the regional drainage network of the Little Powder River. Hay Creek exhibits both intermittent and ephemeral flow characteristics. It is not identified on the USGS hydrologic map of the state of Wyoming nor is it specifically listed in the Surface Water Classification List described in chapter I of the WDEQ/WQD Rules and Regulations. Under the WDEQ/WQD regulations, Hay Creek is classified as a Class 3B stream that is protected for aquatic life (other than fish), recreation, agriculture, industrial uses, and scenic value.

Class 3B waters are tributary waters including adjacent wetlands that are not known to support fish populations or drinking water supplies and where those uses are not attainable. Class 3B waters are intermittent and ephemeral streams with sufficient hydrology to normally support and sustain communities of aquatic life including invertebrates, amphibians, or other flora and fauna that inhabit waters of the state at some stage of their life cycles.

Hay Creek is a third order stream where it leaves the Buckskin Mine's downstream permit boundary but a first order stream where it enters the permit boundary. Hay Creek's watershed at the upstream LBA tract boundary is 2.34 square miles, excluding a closed basin occupying 0.14 square miles primarily in the W½ of section 18. At its confluence with the Little Powder River, Hay Creek drains 14.96 square miles, again excluding closed basin watersheds.

Within the Buckskin Mine permit boundary, the Hay Creek channel has a horizontal length of approximately 16,580 feet based on measurements made on a 10-foot contour interval map prepared from aerial photography and extrapolating the original channel alignment through several channel impoundments. The valley length over the same reach is about 13,290 feet; hence, the ratio of the channel length to valley length (sinuosity ratio) is 1.25. This is a relatively small sinuosity characteristic of immature streams of low order. The channel elevation declines 99.5 feet over the channel length between the permit boundary crossings. This is equivalent to an average channel slope of 0.0060 feet per foot.

Figure 3-10. Surface Water Features Within and Adjacent to the West Hay Creek LBA Tract.

Within the LBA tract analysis area, there are three small impoundments on the main channel of Hay Creek: Impoundment 3, Impoundment 4, and McGee Reservoir (figure 3-10). Immediately to the south of McGee Reservoir, another small impoundment known as Mader Reservoir is located just outside of the LBA tract analysis area on a side channel of Hay Creek. All of these have estimated storage capacities of less than 2 acre-feet, with the exception of McGee Reservoir which has an estimated capacity of about 21 acre-feet.

McGee Reservoir typically fills each summer because of runoff and groundwater overflow from Impoundment 4. Pool elevations in McGee Reservoir fluctuate some five to six feet each year but storage is sufficient to support small fish (fat-head minnows and green sunfish). Mader Reservoir intercepts the water table in sandy slope wash/sheetwash sediments derived from weathering of local, surficial sandstone units. The pool elevation in Mader Reservoir fluctuates little, and it is only about one to two feet deep.

Upstream from McGee Reservoir, the Hay Creek channel is little more than a grassed swale except for a few bedrock cutbanks. Downstream from the reservoir, the channel becomes progressively more incised in slope wash deposits and is typically rectangular to parabolic in shape.

The Buckskin Mine monitored flows and water quality in Hay Creek during 1999 and 2000. Several seeps and springs associated with the Hay Creek drainage within the Buckskin Mine permit area were also monitored. Most local surface waters are a calcium sulfate-type that exceeds WDEQ domestic use standards for sulfate and TDS depending on flow rate and sample location. Several of the upstream samples are sodium bicarbonate type and are believed to be influenced by CBM pumping activities. Surface water quality is usually unsuitable for domestic use, marginal for irrigation, and suitable for stock and wildlife.

Water Rights

Records at the Wyoming State Engineer's Office were searched for groundwater rights within a 3-mile radius of the West Hay Creek LBA tract analysis area. This information is required for WDEQ permitting. SEO data from a records search conducted February, 2000 indicate there are 625 permitted water wells within 3 miles of the tract, of which 41 permitted wells are within the LBA tract as applied for under the Proposed Action. Water rights, which have been abandoned or cancelled, have been excluded from the search.

Of the total number of wells within the search area, coal mining companies own 267 wells (43%). Of the remaining 358 wells within the search area, approximately 92% are permitted for stock watering, 41% are permitted for miscellaneous use, 40% are permitted for CBM development, 9% are permitted for domestic use, and 2% were permitted for monitoring. Other uses amounted to less than 1%. Most of these wells have been permitted for multiple uses. Appendix F contains a listing of the 358 non-coal mine wells and associated water rights information.

SEO records were searched for surface water rights using the SEO's computer database. The search was conducted for surface-water rights within ½ mile of the LBA tract and 3 miles downstream from the permit boundary, as required for WDEQ permitting. This search area covers all of the LBA as applied for and all alternatives.

SEO records indicate 28 permitted surface water rights within the search area. One of the surface water rights is held by a coal mining company, and one is held by an oil and gas company. The remaining 26 other surface water rights are for irrigation, stock watering, and domestic use. Appendix F shows a listing of the 27 noncoal mine surface water rights.

Alluvial Valley Floors (AVFs)

WDEQ regulations define AVFs as unconsolidated stream laid deposits where water availability is sufficient for subirrigation or flood irrigation agricultural activities. Prior to leasing and mining, AVFs must be identified because SMCRA restricts mining activities that affect AVFs that are determined to be significant to agriculture. Impacts to designated AVFs are generally not permitted if the AVF is determined to be significant to agriculture. If the AVF is determined not to be significant to agriculture, or if the permit to affect the AVF was issued prior to the effective date of SMCRA, the AVF can be disturbed during mining but must be restored as part of the reclamation process. The determination of significance to agriculture is made by WDEQ/LQD, and it is based on specific calculations related to the production of crops or forage on the AVF and the size of the existing agricultural operations on the land of which the AVF is a part.

Investigations conducted by Triton to determine the presence of AVFs within and surrounding the Buckskin Mine and analysis area determined there were no AVFs within that area. The WDEQ has concurred with that finding. The nearest declared AVF is south of the analysis area along Rawhide Creek. Portions of that AVF area have been disturbed by mining and re-established by Triton.

Wetlands

"Waters of the US" is a collective term for all areas subject to regulation by the Corps of Engineers (COE) (section 404 of the Clean Water Act). "Waters of the US" include special aquatic sites, wetlands, and jurisdictional wetlands. Special aquatic sites are large or small geographic areas that possess special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values (40 CFR 230.3). Wetlands are a type of *special aquatic site*, which includes those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (33 CFR 328.3(a)(7)(b)). Jurisdictional wetlands are defined by 33 CFR 328.1 and .2 as those wetlands which are within the extent of COE regulatory review." They must contain three components: hydric soils, a dominance of hydrophytic plants, and wetland hydrology.

The presence of jurisdictional wetlands on a mine property does not preclude mining. Jurisdictional wetlands must be identified and special permitting procedures are required to assure that after mining there will be no net loss of wetlands. A wetland delineation must be completed according to approved procedures (COE 1987) and submitted to the COE for verification as to the amounts and types of jurisdictional wetlands present. In Wyoming, once the delineation has been verified, it becomes a part of the mine permit document. The reclamation plan is revised to incorporate at least an equal type and number of jurisdictional wetlands.

Jurisdictional wetland inventories were conducted within the analysis area in 1999 and 2000. The 2000 survey also redelineated the jurisdictional wetlands on land in the S½S½ of sections 19 and 20, T. 52 N., R. 72 W. These lands were first surveyed in 1993. The wetlands delineation was completed in accordance with the procedures and criteria contained in the *Wetland Delineation Manual*. The consolidated delineation was subsequently approved by the COE in April 2001. Buckskin Mine then obtained authorization under the COE Programmatic General Permit 99-03 in July 2001. A total of 23.86 acres of waters of the U.S. have been identified within the LBA analysis area, of which 17.52 acres are jurisdictional wetlands (figure 3-11). Identified jurisdictional wetlands include Riverine - emergent marsh (9.82 acres) and Riverine - wet meadow (7.7 acres).

The additional 6.34 acres of waters of the U.S., which did not qualify as jurisdictional wetlands, include impoundment - stockponds, intermittent/perennial pool (4.20 acres), and riverine - natural ponds (2.14 acres). In addition, approximately 1,811 linear feet of nonwetland waters of the U.S. have been inventoried within the LBA analysis area.

VEGETATION

A vegetation baseline study was completed by Triton on the lands contained within the West Hay Creek LBA tract as applied for under the Proposed Action and Alternatives 2 and 3 in 1999. The baseline study area is located within the northwest portion of the current Buckskin Mine permit area. The vegetation communities in this area were delineated, mapped, and sampled in accordance with the current WDEQ/LQD requirements. The results of the baseline studies, including the Proposed Action lands, were reviewed and approved by WDEQ/LQD as part of an earlier permit amendment. Sampling was conducted on a large enough area to include sufficient room for overburden layback and other mining needs to recover the coal under the Proposed Action and Alternative 3 tracts, however additional lands would need to be added to the permit and survey areas to recover the coal included in Alternative 2.

Figure 3-11. Wetlands Within the West Hay Creek LBA Tract Analysis Area.

A total of eight vegetation types have been identified and mapped within the analyses area. Table 3-8 presents the acreage and percent of the area encompassed by each vegetation type. Figure 3-12 shows the eight vegetation communities, previously disturbed areas, and areas covered by surface water. The vegetation types include lowland prairie, mixed grass prairie, sand prairie, big sagebrush, silver sagebrush, riparian bottomland, agricultural pasture, and agricultural cropland. In addition to the eight vegetation communities, there is also a plains cottonwood tree shelterbelt containing 37 trees located within the analysis area.

**TABLE 3-8
VEGETATION TYPES WITHIN THE ANALYSIS AREA**

Vegetation Type	Acres	Percent of Area
Sandy Prairie Grassland	461.4	40%
Big Sagebrush Shrubland	238.9	21%
Agricultural B Pastureland, High Management	129.7	11%
Agricultural B Cropland	117.3	10%
Lowland Prairie Grassland	55.0	5%
Silver Sagebrush Shrubland	50.7	4%
Agricultural B Pastureland, Moderate Management	47.8	4%
Riparian Bottomland	19.4	2%
Mixed Grass Prairie	7.3	1%
Disturbed by previous Nonmining activities	25.5	2%
Surface Water	6.9	1%
Cottonwood Shelterbelt	0.9	< 0.1%
Total	1,160.8	100.00

Vegetation Types

The Lowland Prairie Type occurs on gently sloping plains and benches adjoining subirrigated bottoms and in closed basins. This type tended to occur on saline soils.

Vegetative cover in the lowland prairie type averages 76%; total ground cover averaged 97%. In order of relative cover, perennial graminoids were dominant with 61% cover followed by perennial forbs (12%) and subshrubs (2%). Dominant grass/grasslike species include Kentucky bluegrass (*Poa pratensis*), alkali bluegrass (*Poa juncifolia*), inland saltgrass (*Distichlis stricta*), crested wheatgrass (*Agropyron cristatum*), slender wheatgrass (*Elymus trachycaulus*), Douglas sedge (*Carex douglasii*), and alkali sacaton (*Sporobolus airoides*). The common forbs are yellow sweetclover (*Melilotus officinalis*), western ragweed (*Ambrosia psilostachya*), wild licorice (*Glycyrrhiza lepidota*), prostrate

Figure 3-12. Vegetation Communities Within the West Hay Creek LBA Tract Analysis Area.

verbena (*Verbena bracteata*), wavyleaf thistle (*Cirsium undulatum*), western yarrow *Achillea lanulosa*, and blue lettuce (*Lactuca oblongifolia*). Shrubs and subshrubs are not dominant components. Common shrubs and subshrubs include rubber rabbitbrush (*Chrysothamnus nauseosus*), cudweed sagewort (*Artemisia ludoviciana*), fringed sagewort (*Artemisia frigida*), and broom snakeweed (*Gutierrezia sarothrae*).

Total perennial/biennial herbaceous production averages 1,849 pounds per acre. Perennial grasses (77% relative production) and perennial forbs (12% relative production) provided most production.

Shrub density averaged 53 plants per acre. Silver sagebrush was the predominant shrub (85% of all shrubs). Subshrub density averages 16 plants per acre (50% broom snakeweed and 50% fringed sagewort).

The Mixed Grass Prairie Type occupies rolling hills and ridges where soils are moderately deep to deep. This type occurs most frequently on loams, sandy clay loams, fine sandy loams, and sandy loams and is likely to occur on the Bidman, Cambria, Kishona, Lawver, Teckla, Wibaux, and Hiland soil series.

Vegetative cover averages 60%; total ground cover averages 88%. In order of relative cover, perennial graminoids are dominant with 62% followed by perennial forbs (10%), shrubs (1.3%) and subshrubs (1%). Dominant grass/grasslike species in the mixed grass prairie include needle-and-thread (*Stipa comata*), prairie junegrass (*Koeleria macrantha*), and western wheatgrass (*Agropyron smithii*). Dominant forbs include western ragweed (*Ambrosia psilostachya*), Sawatch knotweed (*Polygonum sawatchense*), scarlet globemallow (*Sphaeralcea coccinea*), Hood's phlox (*Phlox hoodii*), prairie coneflower (*Ratibida columnifera*), and prairie evening primrose (*Oenothera albicaulus*). Common shrubs and subshrubs are big sagebrush, silver sagebrush, four-wing saltbush (*Atriplex canescens*), broom snakeweed (*Gutierrezia sarothrae*), and fringed sagewort (*Artemisia frigida*).

Total perennial/biennial herbaceous production average 934 pounds per acre. Perennial grasses (78% relative production), perennial forbs (10% relative production), forbs (10%), provided the most production, with shrubs (1.3%), and subshrubs (1%) providing a minor component of production.

Shrub density averages 700 plants per acre, 63% of which are Wyoming big sagebrush, 35% of which are silver sagebrush, and 2% of which are four-wing saltbush. Subshrub density averages 571 plants per acre (26% broom snakeweed, 64% fringed sagewort, and 3% four-wing saltbush).

The Sandy Prairie Type occurs on rolling hills and plains and is associated with windblown areas. This type commonly occupies areas with deep to moderately deep fine sandy loams and sandy loams. Thus, it is likely to occur in Terro, Vonalee, and Vonalf soils.

Vegetative cover averages 57%; total ground cover averages 84%. In terms of relative cover, perennial graminoids are dominant at 65% followed by perennial forbs (11%) and shrubs (3%). Dominant grass/grasslike species include needle-and-thread (*Stipa comata*), prairie sandreed (*Calamovilfa longifolia*), prairie junegrass (*Koeleria macrantha*), threadleaf sedge (*Carex filifolia*), sand bluestem (*Andropogon hallii*) and crested wheatgrass (*Agropyron cristatum*). The common forbs are western ragweed (*Ambrosia psilostachya*), hairy golden aster (*Heterotheca villosa*), scarlet gaura (*Gaura coccinea*), wild licorice (*Glycyrrhiza lepidota*), and low pussytoes (*Antennaria dimorpha*). Common subshrubs and shrubs are prickly phlox (*Leptodactylon pungens*), silver sagebrush (*Artemisia cana*), and Wyoming big sagebrush (*Artemisia tridentata wyo.*).

Total perennial/biennial herbaceous production averages 1,224 pounds per acre and is mainly perennial grasses (78% relative production) and perennial forbs (11% relative production).

Shrub density averages 789 plants per acre--silver sagebrush (48%), Wyoming big sagebrush (20%) and four-wing saltbush (12%) are predominant. Subshrub density averages 1,085 plants per acre with fringed sagewort (90%) and yucca (7%).

The Big Sagebrush Type occurs on a variety of topographic locations including gentle slopes, and rolling hills within the analysis area. It commonly occurs on shallow clay loams (such as Theedle and Shingle series) and deep loams (such as Forkwood and Cushman series) and occasionally occurs on sandy loams. Thus, it could occur throughout the analysis area although it was unlikely to occur on sandy windblown deposits.

Vegetative cover in the big sagebrush type averages 63%; total ground cover averages 90%. In order of relative cover, perennial graminoids contribute 42% followed by shrubs (19%), subshrubs (6%), and perennial forbs with 4%. Dominant grass/grasslike species include needle-and-thread (*Stipa comata*), prairie junegrass (*Koeleria macrantha*), Kentucky bluegrass (*Poa pratensis*), western wheatgrass (*Agropyron smithii*), native bluegrass (*Poa secunda secunda*), and green needlegrass (*Stipa viridula*). Common forbs include Hood's phlox (*Phlox hoodii*), silverleaf scurfpea (*Psoralea argophylla*) scarlet gaura (*Gaura coccinea*), and western yarrow (*Achillea lanulosa*). Common shrubs and subshrubs are Wyoming big sagebrush (*Artemisia tridentata wyo.*), broom snakeweed (*Gutierrezia sarothrae*), and fringed sagewort (*Artemisia frigida*).

Total perennial/biennial herbaceous production averages 1,041 pounds per acre, most of which was provided by perennial grasses (75% relative production), annual grasses (19% relative production), and perennial forbs (4% relative production).

Shrub density averages 5,186 plants per acre (88% big sagebrush and 11% silver sagebrush). Subshrub density averages 3,000 plants per acre (64% broom snakeweed, 34% fringed sagewort, and 2% winterfat).

The Silver Sagebrush Type occurs on gentle to moderately sloping plains and rolling hills as well as ephemeral drainage bottoms and adjacent terraces. This type is found on a variety of soil textures in the Lawver, Teckla, Wibaux and Vonalee series.

Vegetative cover averages 70%; total ground cover averages 95%. Dominant species are needle-and-thread (*Stipa comata*), native bluegrass (*Poa secunda secunda*), Kentucky bluegrass (*Poa pratensis*), threadleaf sedge (*Carex filifolia*), western wheatgrass (*Agropyron smithii*), and prairie sandreed (*Calamovilfa longifolia*). Western ragweed (*Ambrosia psilostachya*), Silverleaf scurfpea (*Psoralea argophylla*), scarlet globemallow (*Sphaeralcea coccinea*) are common forbs. The most common shrubs and subshrub are silver sagebrush (*Artemisia cana*), four-wing saltbush (*Atriplex canescens*), Wyoming big sagebrush, and cudweed sagewort (*Artemisia ludoviciana*).

Total perennial/biennial herbaceous production averages 1,086 pounds per acre as follows: perennial grasses (56% relative production), annual grasses (33% relative production) and perennial forbs (9% relative production).

Shrub density averages 3,988 plants per acre. Silver sagebrush is the dominant shrub at 90%, followed by four-wing saltbush (6%) and Wyoming Big sagebrush (4%). Subshrub density averages 248 plants per acre dominated by fringed sagewort (89%) and broom snakeweed (11%).

The Riparian Bottomland Type is limited in distribution and occurs primarily along Hay Creek. Atypical instances are also located on hillsides associated with groundwater seeps and reservoirs. The riparian bottomland type can be subdivided into two sub-communities: riparian bottomland-meadow and riparian bottomland-marsh. Riparian bottomland-meadow is the predominant subcommunity. The riparian bottomland-marsh type is limited to the perimeters of stock ponds and creek pools. Substrates are characteristically deep and poorly drained and include Boruff series and mollic fluvaquents.

Vegetative cover averages 96%; total ground cover averages 99%. In order of relative cover, perennial/grasslike species provide 85% followed by perennial forbs with 9%. Dominant species are cordgrass (*Spartina pectinata*), common spikesedge (*Eleocharis palustris*), american bullrush (*Scirpus pungens poly.*), thickspike wheatgrass (*Elymus lanceolatus lan.*), Canada bluegrass (*Poa compressa*), clustered field sedge (*Carex praegracilus*), and softstem bulrush (*Scirpus validus*). Common forbs include tufted white prairie aster (*Aster ericoides pansus*), maximilian sunflower (*Helianthus maximiliani*), wild licorice (*Glycyrrhiza lepidota*), and showy milkweed (*Asclepias speciosus*). Wood's rose (*rosa woodsii*) is the most common shrub.

Total perennial/biennial herbaceous production averages 3,103 pounds per acre; most of which was provided by perennial grasses and grasslike species (95% relative production) followed by perennial forbs (3% relative production). Annual grass production was

insignificant at less than 1%.

Agricultural - Pastureland Type. All agricultural pastures within the analysis area are under either moderate or high management levels. Based on the level of management, total vegetation cover ranges from 50% to 78%. Total ground cover ranges from 84% to 95%. Perennial grasses and grasslike species provide 91% relative cover.

Dominant grasses and grasslike species include crested wheatgrass (*Agropyron cristatum*), Kentucky bluegrass (*Poa pratensis*), Canada bluegrass (*Poa compressa*), Russian wildrye (*Elymus junceus*), bulbous bluegrass (*Poa bulbosa*) and thickspike wheatgrass (*Elymus lanceolatus lanceolatus*). Yellow sweetclover (*Melilotus officinalis*) is the most common forb. Shrubs and subshrubs were not present in the transect samples.

Herbaceous productivity for the pasture community is based on countywide hay production values for various soil series present in the analysis area as provided by the Natural Resources Conservation Service. Under average annual rainfall conditions, estimated forage production may range from 1,200 to 3,000 pounds per acre.

Agricultural - Cropland Type. The western portion of the analysis area contains a large amount of croplands. Various small grains were on these lands for quite some time. No vegetation studies were conducted for these croplands.

Threatened, Endangered, and Candidate Plant Species

No federally listed threatened, endangered, or candidate plant species are known to occur within the analyses area. The analysis area was surveyed in 1999 for threatened, endangered and candidate species using the *Wyoming Rare Plant Field Guide* (Thorne 1994) as their reference. Also, refer to appendix G.

WILDLIFE RESOURCES

Background information on wildlife near the West Hay Creek tract was from several sources including: Buckskin Mine WDEQ/LQD permit and annual reports, WGFD and FWS records and personnel contacts with WGFD and FWS biologists.

Site-specific data for the entire proposed lease area were obtained from sources including the WDEQ/LQD permit and annual reports for the Buckskin Mine. Baseline and monitoring surveys cover large perimeters around the permit area. Consequently, the LBA tract was surveyed during annual wildlife monitoring for the Buckskin Mine. Thunderbird Wildlife Consulting, Inc. (TWC), formerly Powder River Eagle Studies (PRES) conducted annual wildlife monitoring at Buckskin Mine from 1984 through 2002. Their current monitoring plan complies with appendix B of the WDEQ/LQD Coal Rules and Regulations. The study area has included most of the LBA analysis area throughout TWC's monitoring timeframe. Baseline wildlife monitoring was conducted on the analysis area concurrent with the Belco

Exchange lands (February 1999 through February 2000). Thus, extensive wildlife data are available for the analysis area. The data presented herein is from TWC's baseline and annual monitoring data.

The LBA tract and adjacent area consists primarily of uplands. The topography is level to rolling, with some areas sloping to steeply sloping. Sagebrush-grassland and grassland are the principal native habitat types in the south and eastern portions of the analysis area. Agricultural pasturelands and croplands dominate the northwest quarter of the analysis area. Bottomland habitat is along Hay Creek (ephemeral stream) in the northern portion of the analysis area. No designated critical, crucial, or unique habitats are present. Several stockponds and natural pools exist on the analysis area. The only trees in the analysis area are 37 cottonwoods in a shelterbelt located near the center of section 20, T. 52 N., R. 72 W. Hay Creek and other unnamed channels on the LBA tract are ephemeral.

Big Game

Pronghorn (*Antilocapra americana*) and mule deer (*Odocoileus hemionus*) are the only big game species that regularly occur on or near the analysis area. Rare sightings of white-tailed deer (*Odocoileus virginianus*) have been recorded.

The WGFD has classified the entire area as yearlong pronghorn range. The Buckskin Mine is at the north end of a larger multi-mine survey area (including Buckskin Mine, Eagle Butte Mine, and Rawhide Mine) that has been surveyed each winter since 1993. Pronghorn densities in the Buckskin area have consistently been lower than those of the multi-mine area.

It is likely that the analysis area is a fringe area of pronghorn use (Triton 2000). Long-term (1987-1998) winter pronghorn density in the Buckskin area has ranged from 2 to 14 animals per square mile (/mi²) but has generally been greater than 8 animals/mi². August 1999 pronghorn density on a 36-mi² survey area, which included the analysis area, was a minimum of 5.6 animals/mi². Records show that the pronghorn reproductive ratio in the Buckskin area often reaches 90 or more fawns per 100 does. This exceeds the WGFD data for northern Campbell County, which indicated a ratio of 57 fawns per 100 does (BLM 2001a).

The analysis area is located within the WGFD's Gillette antelope herd located north of Interstate 90 and is in hunt area 17. The 2001 postseason population estimate is about 12,000 antelope, slightly above the herd objective of 11,000. This is the first time since 1996 that the herd has been at or slightly above objective levels. Drought conditions the past two years has tended to slow herd growth through lower than average fawn survival four of the past five years. The long term average for preseason fawn ratios is approximately 75 fawns to 100 does. However, this herd has not produced an average fawn ratio for 8 years. Historically, the major management problem with this herd has been the ability to achieve an adequate harvest. Most of the antelope are on private land. This is also the case in the LBA tract area. There are no public lands within the analysis area.

and public hunting access is limited. It is unlikely that enough licenses can be sold in the future to achieve the harvest needed to keep this population at its objective (Oedekoven 2002).

The analysis area is located within the Powder River mule deer herd and deer hunt area 18. The herd is currently estimated at 44,000 (postseason 2001), which is approximately 16% below its objective of 52,000 deer. As with antelope, access to private land is limited.

WGFD has classified the majority of the analysis area as yearlong mule deer habitat with a portion of the southeast classified as winter/yearlong. The area is not considered whitetail deer habitat (Oedekoven 2002).

Deer were not numerous in the analysis area during the 1999-2000 baseline study. Only five mule deer were identified in the analysis area during the winter aerial survey. Ground and aerial survey data indicate that deer use was negligible in 1999. Annual monitoring results for the entire Buckskin Mine survey area has shown that the area supports low to moderate numbers of mule deer with the highest numbers generally observed in winter and spring (Triton 2000). Ground counts suggest that mule deer numbers have declined somewhat from the mid-1990s (Triton 2001). Mule deer were recorded in a wide variety of habitat types from 1995 through 2001 but more were generally observed in either mine reclaimed grassland or sagebrush grassland (Triton 2001). Crucial or critical mule deer habitat does not occur on or adjacent to the analysis area (Triton 2000).

Other Mammals

A variety of small and medium-sized mammal species occur near the analyses area. These include predators and furbearers, such as coyote (*Canis latrans*), red fox (*Vulpes vulpes*), striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), and feral cats. Prey species include rodents such as mice, pocket gophers, voles, chipmunks, and lagomorphs (jackrabbits and cottontails). Surveys for prairie dog towns were conducted on the analysis area and adjacent lands. No prairie dog towns were identified within the analysis area. The closest prairie dog town to the LBA tract is located in the SE $\frac{1}{4}$ of section 9 and the SW $\frac{1}{4}$ of section 10, T. 52 N., R. 72 W. There is also another prairie dog town located in section 4, T. 52 N., R. 72 W. approximately 1.75 miles north of the analysis area. Both of these towns are shown on figure 3-13. These mammal species are cyclically common and widespread throughout the region. The prey species are important for raptors and other predators.

Raptors

Numerous raptor species were observed on or adjacent to the West Hay Creek LBA tract. These species include the golden eagle (*Aquila chrysaetos*), bald eagle (*Haliaeetus leucocephalus*), northern harrier (*Circus cyaneus*), Swainson's hawk (*Buteo swainsoni*), red-tailed hawk (*Buteo jamaicensis*), ferruginous hawk (*Buteo regalis*), rough-legged hawk (*Buteo lagopus*), prairie falcon (*Falco peregrinus*), American kestrel (*Falco sparverius*), turkey vulture (*Carthartes aura*), great horned owl (*Bubo virginianus*), short-eared owl (*Asio flammeus*) and burrowing owl (*Athene cunicularia*). Although numerous raptor species have been observed in the area, none have nested on the site due to limited suitable habitat (cliffs and tall trees). Figure 3-13 shows the locations of raptor nest sites identified since monitoring began for Buckskin Mine in an area that includes the West Hay Creek LBA tract. The figure shows 13 intact nest sites. As of June 2002, all of the nest sites were still intact but only represented three active nests, all of which were used by red-tailed hawk pairs. Two nests previously used by great horned owls in 1999 through 2001 were not used in 2001. The golden eagle nest site was not used from 1999 through 2002.

Game Birds

Three species of upland game birds were observed during the 1999 baseline study: the sage grouse (*Centrocercus urophasianus*), sharp-tailed grouse (*Pedioecetes phasianellus*), and gray partridge (*Perdix perdix*). The sage grouse is the most commonly encountered species in the analysis area. No sage grouse leks were identified within the analysis area. One lek formerly existed in the NE $\frac{1}{4}$ SW $\frac{1}{4}$ of section 16.T. 52 N, .R. 72 W. east of the analysis area. That lek was active in 1992, and inactive in 1995, 1997, and 1999. Despite the lack of leks, breeding and brood-rearing habitat is present. Wintering habitat is limited in the analysis area, and no sage grouse or sage grouse sign was found during the winter baseline surveys.

Two active sharp-tailed grouse leks were identified in 2002 on lands adjacent to the LBA tract. As shown on figure 3-13, one lek is within $\frac{1}{4}$ mile of the analyses area (Triton 2002).

Gray partridge, an introduced species, is most commonly observed in the vicinity of seeded grass/haylands and small grain croplands. Three observations, all outside of the analysis area, were recorded during the 1999 baseline study (Triton 2000).

Mourning doves (*Zenaida macroura*) were on or near the analysis area during spring and summer surveys. This species is a relatively common breeding bird in Campbell County. Occasional turkey (*Meleagris gallopavo*) and pheasant (*Phasianus colchicus*) observations have been recorded during wildlife monitoring activities at the Buckskin Mine. Therefore, both species could possibly be recorded within the 2-mile perimeter of the analysis area (Triton 2000).

**Figure 3-13. Raptor Nests Sites, Grouse Leks, and Prairie Dog Colonies Within and Adjacent to the West Hay Creek Analysis Area.
(Status as of 06-05-02).**

Migratory Birds of High Federal Interest (MBHFI)

Table 3-9 provides a list of those species that potentially may occur on or within ½-half mile of the analysis area.

The following listed species were observed during the 1999 through 2002 surveys or are expected to occur in or adjacent to the analysis area. The ferruginous hawk (*Buteo regalis*) is classified as common and an historical breeder. Only one observation of a ferruginous hawk was recorded during the entire baseline study. However, they are assumed to have nested in the analyses area because nests characteristic of the ferruginous hawk were found within one mile north of the analyses area. Such ground nests can persist for many years. No nesting activity was observed during the 1999 baseline study or 2000 through 2002 annual surveys. Suitable nesting habitat for the short-eared owl (*Asio flammeus*) such as hayfields and tall weeds is present though no nests were located during the baseline survey. It was classified as uncommon and infrequently observed. The Swainson's hawk (*Buteo swainsoni*) was classified as common but a rare breeder to the area. The bald eagle (*Haliaeetus leucocephalus*) is seasonally common and most frequently observed in the winter (Triton 2000, 2002).

Sage grouse (*Centrocercus urophasianus*), recently added to the Level 1 list is common to the area and is classified as an occasional breeder.

The grasshopper sparrow (*Ammodramus savannarum*) and lark bunting (*Calamospiza melanochorys*) were observed several times within the grassland habitat. Based on 1999 through 2002 data, lark buntings are common breeders and the grasshopper sparrow is an occasional breeder within the area. The vesper sparrow (*Pooecetes gramineus*) and the lark sparrow (*Chondestes grammacus*) were classified as common to the area. The McCowan's longspur (*Calcarius mccownii*) and the less common chestnut-collared longspur (*Calcarius ornatus*) were also infrequently or rarely observed and classified as potential breeders within the grassland habitat type. Lark buntings were also common to the sagebrush-grasslands and bottomlands. Though not found in the grasslands, the Brewer's sparrow (*Spizella breweri*) is a very common species and breeder in the sagebrush-grasslands within the analysis area.

The upland sandpiper (*Bartramia longicauda*) was classified as infrequently observed and as a potential breeder within the analysis area.

The burrowing owl (*Athene cunicularia*), is uncommon and classified as an infrequent breeder within the analyses area. The loggerhead shrike (*Lanius ludovicianus*), and long-billed curlew (*Numenius americanus*) were classified as uncommon and infrequently observed (Triton 2002).

Suitable habitat for the mountain plover occurs in the analysis area, particularly in the sandy prairie grassland areas; however, mountain plovers have not been recorded in the area.

TABLE 3-9
REGIONAL STATUS OF 40 MIGRATORY BIRDS OF HIGH FEDERAL INTEREST
ON AND WITHIN ½ MILE OF THE WEST HAY CREEK LBA TRACT

Species	Seasonal Status/ Breeding Records in Northeastern WY ¹	Expected Occurrence in Vicinity of West Hay Creek ²	Occurrence and Historical Breeding Status at West Hay Creek
LEVEL I			
Mountain plover <i>Charadrius montanus</i>	summer/observed	rare	never recorded
Sage grouse* <i>Centrocercus urophasianus</i>	resident/breeder	common	occasional breeder
McCown's longspur* <i>Calcarius mccownii</i>	summer/breeder	uncommon	infrequently observed
Baird's sparrow <i>Ammodramus bairdii</i>	never recorded	rare	never recorded
Ferruginous hawk* <i>Buteo regalis</i>	resident/breeder	common	historical breeder
Brewer's sparrow* <i>Spizella breweri</i>	summer/breeder	common	regular breeder
Sage sparrow <i>Amphispiza belli</i>	summer/observed	uncommon	never recorded
Swainson's hawk* <i>Buteo swainsoni</i>	summer/breeder	common	rare breeder
Long-billed curlew* <i>Numenius americanus</i>	summer/breeder	uncommon	infrequent spring migrant
Short-eared owl* <i>Asio flammeus</i>	resident/breeder	uncommon	infrequently observed
Peregrine falcon <i>Falco peregrinus</i>	resident/observed	rare	never recorded
Burrowing owl* <i>Athene cunicularia</i>	summer/breeder	uncommon	Infrequent breeder
Bald eagle* <i>Haliaeetus leucocephalus</i>	resident/observed	seasonally common	frequent in winter
Upland sandpiper* <i>Bartramia longicauda</i>	summer/breeder	uncommon	infrequently observed
LEVEL II			
Cassins's Kingbird <i>Tyrannus vociferans</i>	summer/breeder	uncommon	never recorded
Lark bunting* <i>Calamospiza melanocorys</i>	summer/breeder	common	common breeder
Dickcissel <i>Spiza americana</i>	summer/observed	rare	never recorded
Chestnut-collared longspur* <i>Calcarius ornatus</i>	summer/breeder	uncommon	rarely recorded
Black-chinned Hummingbird <i>Archilochus alexandri</i>	never recorded	not expected	never recorded
Pygmy nuthatch <i>Sitta pygmaea</i>	resident/observed	not expected	never recorded

TABLE 3-9 (cont)

Species	Seasonal Status/ Breeding Records in Northeastern WY ¹	Expected Occurrence in Vicinity of West Hay Creek ²	Occurrence and Historical Breeding Status at West Hay Creek
Marsh wren <i>Cistothorus palustris</i>	summer/observed	uncommon	never recorded
Western bluebird <i>Sialia mexicana</i>	summer/observed	uncommon	never recorded
Sage thrasher* <i>Oreoscoptes montanus</i>	summer/breeder	common	rarely observed
Grasshopper sparrow* <i>Ammodramus savannarum</i>	summer/breeder	common	occasional breeder
Bobolink <i>Dolichonyx oryzivorus</i>	summer/observed	uncommon	never recorded
Common loon <i>Gavia immer</i>	summer/observed	not expected	never recorded
Black-billed cuckoo <i>Coccyzus erythrophthalmus</i>	summer/breeder	uncommon	never recorded
Red-headed woodpecker <i>Melanerpes erythrocephalus</i>	summer/observed	uncommon	never recorded
Yellow-billed cuckoo <i>Coccyzus americanus</i>	never recorded	uncommon	never recorded
Eastern screech-owl <i>Otus asio</i>	never recorded	uncommon	never recorded
Western screech-owl <i>Otus kennicottii</i>	never recorded	uncommon	never recorded
Western scrub-jay <i>Apheloma californica</i>	never recorded	uncommon	never recorded
Loggerhead shrike* <i>Lanius ludovicianus</i>	summer/breeder	uncommon	infrequently observed
Vesper sparrow* <i>Poocetes gramineus</i>	summer/breeder	common	common breeder
Lark sparrow* <i>Chondestes grammacus</i>	summer/breeder	common	occasional breeder
Ash-throated flycatcher <i>Myiarchus cinerascens</i>	never recorded	abundance unknown	never recorded
Bushtit <i>Psaltiriparus minimus</i>	never recorded	uncommon	never recorded
Merlin* <i>Falco columbarius</i>	resident/breeder	uncommon	rarely observed
Sprague's pipit <i>Anthus spragueii</i>	migrant/observed	Uncommon	never recorded
Barn owl <i>Tyto alba</i>	summer/breeder	abundance unknown	never recorded

¹Compiled from Luce et al. (1999), for lat-long block that encompasses northern Campbell County.

²Expected occurrence on or within ½ mile of Buckskin Mine was based on range, history of occurrence, and habitat availability.

*Species highlighted with asterisks were recorded on or within ½ mile of Buckskin Mine during baseline or monitoring studies at least once before or during May 2002.

Source: Luce, B., A. Cerovski, B. Oakleaf, J. Priday, and L. Van Fleet. 1999. Atlas of Birds, Mammals, Reptiles, and Amphibians in Wyoming. Wyoming Game and Fish Department, Cheyenne, Wyoming.

Additional MBHFI species are not expected to occur on the analysis area, although marginal potential habitat for some was identified within the 1999 survey area. These include the barn owl (*Tyto alba*), Sprague's pipit (*Anthus spragueii*), dickcissel (*Spiza americana*), Baird's sparrow (*Ammodramus baridii*). Of these species, PRES only observed one dickcissel during their years of monitoring the mines in northern Campbell County. Other species listed on table 3-9 have been rarely or never recorded in the analyses area.

Other Species

Wildlife surveys completed specifically in the analyses area and surveys completed for the adjacent mines have documented numerous other wildlife species that inhabit the area. All of these species were generally common inhabitants of the area and none were of specific concern to state or federal agencies. Lists of species recorded at the Buckskin Mine and within the analyses area are in the mine's permit document available at WDEQ/LQD.

Under current natural conditions, the LBA tract provides limited waterfowl and shorebird habitat. This habitat is mainly available during spring migration as ponds and ephemeral streams. Many of these water features generally get quite low or dry up during the summer. However, persistent ponds do remain on the upper reaches of Hay Creek within the analyses area. Broods from five waterfowl species were observed during the 1999 baseline study. These were the American wigeon (*Anas Americana*), blue-winged teal (*Anas discors*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), and northern shoveler (*Anas clypeata*). CBM activity also provides additional water to some small stock ponds adjacent to the analyses area

Fish species are not normally found on the LBA tract. Pool elevations in McGee Reservoir fluctuate some five to six feet each year but storage is sufficient to support small fish (fat-head minnows and green sunfish). Due to the ephemeral drainages within the analyses area, fish surveys were not required during the baseline study by the WGFD or WDEQ/LQD.

Appendix G contains a discussion of threatened, endangered and proposed animal species.

OWNERSHIP AND USE OF LAND

Triton Coal Company, LLC owns the surface on the West Hay Creek LBA tract analysis area, including the LBA area as applied for and areas added under Alternatives 2 and 3 (figure 3-14). The principal land use within the tract is domestic grazing and wildlife habitat (Triton 2002). Secondary land uses are agricultural cropland and hayland. Areas of disturbance within the West Hay Creek LBA tract include plugged and abandoned oil and gas wells, CBM wells and associated utilities/easement corridors, ranch access roads, and mine monitoring access roads.

Figure 3-14. Surface Ownership on the West Hay Creek LBA Tract.

All of the coal estate included in the LBA tract is federally owned. Figure 3-15 shows that the oil and gas estate within the analyses area is both federally and privately owned. All of the federally owned oil and gas estate is leased. Table 3-10 provides a list of the lessees of record for the federally owned oil and gas estate.

The Supreme Court has ruled that CBM rights belong to the owner of the oil and gas rights (98-830). Therefore, the oil and gas lessees have the right to develop the CBM in the coal as well as the right to develop conventional oil and gas on the tract.

There are no conventional oil or gas wells in the analyses area. There were seven CBM wells located on the LBA tract that are capable of production as of October 28, 2002. Extensive CBM development occurs west of the tract.

The WOGCC has established 80-acre spacing patterns as the default spacing for CBM wells in the Powder River Basin. Most CBM drilling near the West Hay Creek LBA tract has occurred on a 40-acre pattern, presumably under the authorization of spacing exceptions granted by WOGCC. There are 7 remaining undrilled complete or partial 80-acre spacing units on the LBA tract and 15 undrilled 40-acre units. Complete CBM development of the LBA tract would require either 7 or 15 additional wells depending on the development pattern. WOGCC records indicate that, as of October 31, 2002, development is continuing on a general 40-acre pattern. Wells have been proposed on 10 of the remaining undrilled 40-acre spacing units.

Certain ancillary facilities are needed to support oil and gas production. These support facilities may include well access roads, well pads, production equipment at the wellhead (which may be located on the surface and/or underground), well production casing (which extends from the surface to the zone of production), underground pipelines (which gather the oil, gas and/or water produced by the individual wells and carry it to a larger transmission pipeline or collection facility), facilities for treating, discharging, disposing of, containing, or injecting produced water, central metering facilities, electrical power utilities, gas compressor stations, and high-pressure transmission pipelines for delivering the gas to market. Support facilities would be constructed on the LBA tract if operations resume on the existing wells or if new CBM wells are drilled and completed.

Coal mining is a dominant land use in the area surrounding the LBA tract. The Buckskin Mine is within a group of five operating surface coal mines located in northern Campbell county (figure 1-1). Coal production at these five mines increased by about 17% between 1993 and 2001 (from about 44 million tons in 1993 to about 51 million tons in 2001). Since 1992, one maintenance coal lease and one lease exchange was completed for this mine group. Applications have been submitted for two maintenance tracts in this same group, including the LBA being evaluated in this EIS (tables 1-1 and 1-2).

Figure 3-15. Oil and Gas Ownership on the West Hay Creek LBA Analysis Area.

TABLE 3-10
OIL AND GAS OWNERSHIP ON THE WEST HAY CREEK LBA TRACT
(T. 52 N., R. 72 W)

Location	Lease Number	Lessee of Record
<u>Section 17</u>		
Lot 8	WYW 134209	Majestic Petro Operations, LLC; Preston Reynolds & Co., Inc.; Redstone Resources, Inc.; Woodward Enterprises, LLC
Lots 6, 7, 10, 11, 14	WYW 138419	Maurice W. Brown
<u>Section 19</u>		
Lots 13, 20	WYW 138419	Maurice W. Brown
<u>Section 20</u>		
Lots 3, 6, 10, 11	WYW 138419	Maurice W. Brown

Note: Oil and gas rights (including coal bed methane) for the remainder of the LBA tract are privately owned.

Campbell County has no applicable countywide land use plans, and the LBA tract has no designated zoning classification. The *City of Gillette/Campbell County Comprehensive Planning Program* (City of Gillette 1978) provides general land use goals and policies for state and federal coal leases in the county.

Big game hunting is the principal recreational use in the analysis area. Landownership within the PRB is 80% private, but some private landowners permit sportsmen to cross and/or hunt on their land. Others charge an access fee, and some do not allow any access. There has been a trend over the past two decades towards a substantial reduction in lands open and reasonably available for hunting. Access fees continue to rise, and many resident hunters feel these access fees are unreasonable. This trend has created problems for the WGFD in their attempt to distribute and control harvest at optimal levels, as well as to sportsmen who desire access to these animals (WGFD 1996). Due to safety concerns, public lands contained within an active mining area are often closed to the public, further limiting recreational use. In the PRB, the publicly owned Thunder Basin National Grasslands, BLM-administered public lands, and state school sections (normally sections 16 and 36) are generally open to hunting if legal access is available. As shown in figure 3-14, there are no public surface lands included in the West Hay Creek LBA tract.

The surface estate of all of the lands within the LBA tract under the Proposed Action and the alternative configurations is privately owned, and recreational use is allowed only with landowner permission. Sport hunting in varying degrees occurs on the LBA tract. Pronghorn and mule deer occur on and adjacent to the LBA tract. Sage grouse, mourning dove, waterfowl, rabbit, and coyote are hunted in the vicinity, and some coyote and red fox trapping may occur.

CULTURAL RESOURCES

Cultural resources, protected under the National Historic Preservation Act of 1966, are the nonrenewable remains of past human activity. The PRB appears to have been inhabited by aboriginal hunting and gathering people for more than 11,000 years. Throughout the prehistoric past, highly mobile hunters and gatherers who exploited a wide variety of resources used the area.

The general chronology for aboriginal occupation (dated as years before present [B.P.]) is:

- the Paleoindian period (11,000-7,500 years B.P.),
- the Archaic period (7,500-1,800 years B.P.),
- the Prehistoric period (1,800-400 years B.P.),
- the Protohistoric period (400-200 years B.P.), and
- the Historic period (200-120 years B.P.).

The Paleoindian period includes a series of cultural complexes identified by distinctive large projectile points (spear points) often associated with the remains of large, now-extinct mammals (mammoth, bison, camel, etc.). The Archaic period is characterized by a range of smaller side-notched, stemmed, or corner-notched projectile points and by more generalized subsistence pursuits including gathering plants. This lifeway continued to the late Prehistoric period, which is marked by a technological change from dart projectiles to the bow and arrow and by the appearance of ceramics. During the Archaic and late Prehistoric periods, the PRB was occupied by small bands of hunters and gatherers whose movements were determined largely by seasonal and environmental changes that influenced the occurrence of subsistence resources (BLM 1979).

Protohistoric and early Historic sites are found in the PRB, including rare historic trade goods, sites, and routes associated with early trappers and military expeditions, and early ranching attempts dating to the 1880s. A few small coal mining sites also exist.

A Class III cultural resources survey is a professionally conducted, intensive inventory of a target area, designed to locate all cultural properties that have surface and exposed profile indications. Cultural properties are recorded and sufficient information collected on them to allow evaluation for possible inclusion in the NRHP. That determination is made by the managing federal agency in consultation with State Historic Preservation Office (SHPO). Consultation with SHPO must be completed before the MLA mining plan is approved. Until consultation with SHPO has occurred and agreement regarding National Register of Historic Places (NRHP) eligibility has been reached, all sites should be protected from disturbance.

Once a Class III survey is completed, site-specific testing or limited excavation is used, if necessary, to gather additional data which will: 1) determine the final evaluation status of a site and/or 2) form the basis of additional work that will be conducted during implementation of a treatment plan if the site is eligible for the NRHP. A treatment plan is developed for those sites that are eligible for the NRHP and are within the area of potential

effect. Treatment plans are implemented before mining and can include such mitigating measures as avoidance (if possible), large-scale excavation, complete recording, historic American building survey/historic American engineering record documentation, archival research, and other acceptable scientific practices.

TRC Mariah Associates of Laramie, Wyoming subjected the West Hay Creek LBA analysis area to a Class III cultural resource inventory and assessment in 1999. The analysis area covered all lands proposed for coal lease and a buffer zone that would include all disturbances for the Proposed Action and Alternative 3 assuming the area is mined as a maintenance tract for the existing adjacent mine. The goal of the inventory was to locate and evaluate for the NRHP all cultural resources 50 years and older within the study area. WDEQ, Office of Surface Mining, Reclamation, and Enforcement (OSM) and the Wyoming SHPO reviewed and approved the survey results. Previous cultural resource inventories were conducted in and adjacent to the analysis area in association with oil and gas development and previous mine permitting activities.

Three historical sites were identified within the analysis area. Site 48CA1836 is a homestead that was originally recorded in 1982. The site consists of the remains of the main house, three bunkhouses, four sheds, one corral and one dugout depression. Site 48CA3376 consists of three earthen dams and their reservoirs, one three-sided rock foundation, and a detached separate roof. The third site, 48CA3386, is a linear rock alignment. No other artifacts were found in association with the site. None of the sites met the criteria for eligibility to the NRHP.

Nine prehistoric sites were identified in the analysis area. All of the nine sites potentially located within the Proposed Action and alternative areas are lithic scatters. Two of four previously recorded sites could not be located again in 1999. One site met the eligibility criteria for the NRHP. The survey results have been reviewed and approved by WDEQ, OSM, and the Wyoming SHPO. A data recovery plan has been developed and will be implemented.

Table 3-11 summarizes the distribution of cultural sites by type.

TABLE 3-11
RESULTS OF THE CLASS III CULTURAL RESOURCE INVENTORY OF THE
WEST HAY CREEK LBA TRACT ANALYSIS AREA

Prehistoric Sites	
Lithic scatter or possible open camp	48CA857; 858; 859; 1615; 3377; 3379; 3380; 3385 and 3387
Isolated finds	13 lithic items
Historic Sites	
Homestead	48CA1836
Earthen dams/ structures	48CA3376
Stone alignment	48CA3386

Native American Concerns

Native American heritage sites are classified as prehistoric or historic. Some may be being used as offering sites and fasting or vision quest sites, and selected rock art sites. Other sites of cultural interest and importance may include rock art sites, stone circles and various rock features, fortifications or battle sites, burials, as well as locations that are sacred or part of the oral history and heritage that have no man-made features.

To date, no Native American sacred sites in the general analysis area have been documented. However, the position of the area between mountains considered sacred by various Native American cultures (the Big Horn Mountains to the west, the Black Hills and Devils Tower to the east) creates the possibility of existing locations which may have special religious or heritage significance to Native American groups.

Native American tribes were consulted at a general level in 1995-1996 as part of an effort to update the BLM Buffalo RMP. Tribes that have been potentially identified as having concerns about actions in the PRB include: the Crow, Northern Cheyenne, Shoshone, Arapaho, Oglala Lakota, Rosebud Sioux, Flandreau Santee Sioux, Santee Sioux, Crow Creek Sioux, Lower Brule Sioux, Standing Rock Sioux, and Cheyenne River Sioux. OSM completed the Native American consultation in 2000 on lands within the analysis area. No comments were received. OSM then notified the SHPO that the one site of concern, 48CA860, was not a traditional cultural property.

PALEONTOLOGICAL RESOURCES

The formations exposed on the surface of the PRB are the sedimentary Eocene Wasatch and Paleocene Fort Union formations, which are both known to contain fossil remains. Some paleontological surveys have been conducted in the PRB. Vertebrate fossils that have been described from the Wasatch Formation include mammals such as early horses, tapiroids, condylarths, primates, insectivores, marsupials, creodonts, and carnivores; reptiles such as crocodilians, alligators, lizards, and turtles; birds, eggs, amphibians, fish, plants, and nonmarine invertebrates such as mollusks and ostracods. The Fort Union also contains fossils of plants, reptiles, fish, amphibians, and mammals.

A paleontological survey was conducted within and adjacent to the West Hay Creek LBA tract in 1999 to determine the potential for recovery of significant fossils prior to disturbance. Fragmentary crocodile scutes and invertebrate gastropod and bivalve shell fragments were located in section 21, T. 52 N., R. 72 W. Petrified wood was also abundant on the hill slopes in that area. No vertebrate or invertebrate fossils or plant material was collected, as all of it was fragmentary and considered to be of limited scientific significance.

VISUAL RESOURCES

Visual sensitivity levels are determined by people's concern for what they see and the frequency of travel through an area. Common throughout the analyses area are landscapes that include rolling sagebrush and short-grass prairie. Existing surface mines form a somewhat continuous band on the east side of US Highway 14-16 north of Gillette and a nearly continuous band on the east side of Wyoming Highway 59 from Gillette south about 50 miles. Other man-made intrusions include ranching activities (fences, homesteads, and livestock), oil and gas development (pumpjacks, pipeline right of ways, CBM well shelters, and CBM compressor stations), transportation facilities (roads and railroads) and electric power transmission lines. The natural scenic quality in the immediate lease area is relatively low because of this development and the existing surface coal mining operations.

The Buckskin and Rawhide Mine facilities and some mining activities are visible from US 14-16 and Collins and McGee county roads. This is also true for portions of the LBA tract.

For management purposes, BLM evaluated the visual resources on lands under its jurisdiction in the Buffalo RMP. The inventoried lands were classified into visual resource management (VRM) classes as follows:

Class I - Natural ecologic changes and very limited management activity is allowed. Any contrast (activity) within this class must not attract attention.

Class II - Changes in any of the basic elements (form, line, color, texture) caused by an activity should not be evident in the landscape.

Class III - Contrasts to the basic elements caused by an activity are evident but should remain subordinate to the existing landscape.

Class IV - Activity attracts attention and is a dominant feature of the landscape in terms of scale.

Class V - This classification is applied to areas where the natural character of the landscape has been disturbed up to a point where rehabilitation is needed to bring it up to the level of one of the other four classifications.

The lands in the West Hay Creek LBA tract are generally classified as VRM Class IV. The existing mining activity is visible from several sites on the LBA tract.

NOISE

Existing noise sources in the area include adjacent coal mining activities, traffic on Wyoming 59, US 14-16, and the Collins and McGee county roads, rail traffic, ranching activities, and wind. No site-specific noise level data are available for the area. Because the Buckskin Mine is adjacent to the proposed LBA, a median noise level is estimated to be 40 to 60 dBA for day, evening, and nighttime, with the noise level increasing with proximity to active mining at the Buckskin Mine. Mining activities are characterized by noise levels of 85 to 95 dBA at 50 feet from actual mining operations and activities (BLM 1992b). The nearest occupied dwelling to the LBA tract is located approximately ½ mile north of the northwestern corner of the LBA tract analysis area, in the SW¼SE¼ of section 7, T. 52 N., R. 72 W. Figure 3-16 presents noise levels associated with some commonly heard sounds.

TRANSPORTATION FACILITIES

Transportation resources near the West Hay Creek LBA tract include US 14-16, Wyoming 59, and the Collins and McGee county roads. US 14-16 is about 2 miles west of the LBA tract area and, Wyoming 59 lies approximately 3 miles east. Both highways are paved two-lane roads that run generally north-south. The county roads are improved two-lane roads that also run roughly north-south. The Collins County Road is about 1 mile west of the LBA tract area; and the McGee County Road branches east of Collins Road about 3,000 feet from the northeast corner of the analysis area. Several unnamed two-track roads either cross the area or are adjacent to it.

Access to the LBA tract is on unnamed two-track roads off McGee Road via Collins Road and US 14-16.

Figure 3-16. Transportation Facilities Within and Adjacent to the West Hay Creek LBA Tract Analysis Area.

The nearest railroad facilities are the Burlington Northern/Santa Fe Railroad spurs accessing the Buckskin Mine 1.5 miles south of the proposed LBA tract area, and the Rawhide Mine approximately 5 miles southeast of the proposed LBA tract area. The Buckskin Mine railroad loop is the northern terminus of a series of spur lines that serve the surface coal mines north of Gillette. Oil and gas pipelines, power lines, and associated ROWs are found in the analysis area. However, no telephone lines are located within the proposed tracts.

Current transportation facilities within and adjacent to the LBA tract are depicted on figure 3-17. Since the West Hay Creek LBA tract as applied for would be an extension of the existing Buckskin Mine operations, the existing coal transportation facilities and infrastructure would be used during mining of the LBA tract.

SOCIOECONOMICS

The social and economic study area for the proposed project involves primarily Campbell County and the cities of Gillette and Wright. The community of Gillette would most likely attract the majority of any new residents due to its current population level and the availability of services and shopping amenities.

A comprehensive socioeconomic profile of the Buffalo Field Office area (formerly the Buffalo Resource Area, which includes all of Campbell County) was prepared for the BLM under contract with the Department of Agricultural Economics, College of Agriculture, through the University of Wyoming's Cooperative Extension Service (University of Wyoming 1994). The portion of the following discussion that deals with Campbell County is from this report. Additional data came from the Wyoming Department of Commerce, Wyoming Division of Economic Analysis, Wyoming Department of Employment, Wyoming Economic Development Office, and personal communications with local community development staff.

Population

According to 2000 census data, Campbell County had a population of 33,698, with Gillette accounting for 19,646 of the county's residents and Wright with 1,347. The 1990 population of Gillette was 17,635, indicating a growth rate of 11.4% in the past 10 years.

CBM-spurred population growth is occurring in Gillette. The current CBM boom is contributing to low housing vacancy and a tight labor market. To date, however, enrollments in Gillette-area schools have not increased because of CBM development due to a mobile, relatively young work force.

Figure 3-17. Relationship Between A-Scale Decibel Readings and Sounds of Daily Life.

Local Economy

Coal production, as reported by the Wyoming State Inspector of Mines, showed the Wyoming's coal producers set a new yearly production record of 368.9 million tons in 2001. This was an increase of 8.9% over the 338.9 million tons produced in 2000. Campbell County coal production (12 active mines) increased by 10% (299.5 million tons to 329.5 million tons) from 2000 to 2001.

Table 3-12 shows approximate tax revenues from coal production in Campbell County. Sales and use taxes are distributed to cities and towns within the county and to the county's general fund. Severance taxes are collected by the state for the removal or extraction of resources such as oil, natural gas, coal, and trona. The state of Wyoming retains approximately 83% of the severance tax, and the remainder is returned to the cities, towns, and counties. Ad valorem taxes, which include property taxes, are collected by the county and disbursed to schools, cities, towns, the state foundation, and various other subdivisions within the county. Mineral royalties are collected on the amount of production and the value of that production. The current royalty rate for federal coal leases is 12.5%, with half of this revenue returned to the state. Additional sources of revenue include lease bonus bids (also split with the state) and annual rentals that are paid to the federal government. The total fiscal benefit to the state of Wyoming from coal mining in the PRB was estimated at \$1.10 per ton of coal mined in a 1994 study conducted for BLM by the University of Wyoming (University of Wyoming 1994).

TABLE 3-12
CAMPBELL COUNTY ESTIMATED 2001 FISCAL REVENUES¹
FROM 2000 COAL PRODUCTION
(in millions)

County	Sales and Use Collections	Severance Tax Collections	Ad Valorem Tax Collections	Royalty Collections	Total Collections
Campbell	\$23.5	\$85.9	\$78.7	\$131.6	\$344.9

¹Estimated tax receipts are based on information from the Wyoming Department of Revenue and from results of a survey conducted by the Wyoming Mining Association.

Nationally, the minerals industry is 1.3% of the gross national product (GNP). In Wyoming, the minerals industry (including oil and gas) is 31% of the gross state product (GSP), which makes it the largest sector of the Wyoming economy. Coal mining alone accounts for 9% of the Wyoming GSP (Wyoming Department of Administration and Information 1999).

Employment

Coal mining has changed a great deal since the 1970s, and new technologies have been a major contributor to these changes. The local coal mining labor force grew during the 1970s but declined during the 1980s. Since 1973, overall production has risen while employee numbers have decreased. This employment decline followed large industry capital investments in facilities and production equipment, the majority of which was aimed at increasing productivity.

The coal mining labor force in Campbell County has remained relatively constant over the past several years. An average of 3,220 persons was employed at coal mining occupations from 1995 through 2000 (Wyoming Department of Employment, Research and Planning 2000).

In 2001, Campbell County had an average total labor force of 22,360 with an unemployment rate of 2.9%, compared to 3.4% in 2000. Coal mining employment represented 16% of the total labor force in Campbell County in 2000 (Wyoming Department of Employment, Research and Planning 2001).

Housing

According to the 2000 census, Campbell County contained 13,288 housing units, 7,931 of which were in Gillette. Residential building permits in Campbell County rose from 15 in 1987 to 82 in 1992 to 100 in 1998 (the last year that data are available). In early 2000, the average cost of a new 3-bedroom home in Gillette was \$133,000; the average cost of an existing 3-bedroom home was \$100,000. Approximately 200 homes are available through the Gillette real estate market, for a vacancy rate of 2.5% (Campbell County Economic Development Council 2002).

Local Government Facilities and Services

Gillette has generally maintained a steady population growth since 1987, when it totaled 17,054. Owing to the substantial revenues generated by mineral production, local government facilities and services have kept pace with growth and are adequate for the current population. The opening of the new South Campus of Campbell County High School has helped to alleviate overcrowding at the North Campus. South Campus opened on February 1, 1999, and is used by approximately 600 students and 30 teachers.

Social Conditions

Despite past boom and bust cycles in the area's economy, a relatively stable social setting now exists in these communities. Most residents have lived in the area for a number of years, social ties are well established, and residents take great pride in their communities.

Many of the people place a high priority on maintaining informal lifestyles and small town traditions, and there are some concerns that the area could be adversely affected by more than a modest growth in population. At the same time, there is substantial interest in enhancing the economic opportunities available in the area and a desire to accommodate reasonable levels of growth and development.

Wyoming's economy reached the bottom of an energy bust in 1987 and started to recover (Wyoming Department of Administration and Information 1999). That recovery began to slow in 1996. The forecast is for slow growth through 2008; Wyoming's population is projected to increase at 0.5% per year. Nonagricultural employment is projected to increase by 22% by 2008, increasing 1.4% in 2000 and then slowing to 1.1% per year by 2006. Mining employment is projected to decline by 8.2% by 2008. In 1998, there were 17,000 jobs in the mining sector. This dropped to 15,600 in 1999, with 1,000 jobs lost in oil and gas extraction, 300 in nonmetallic minerals and 100 in coal mining (Wyoming Department of Administration and Information 2000).

Environmental Justice

Environmental justice issues are concerned with actions that unequally affect a given segment of society because of physical location, perception, design, and noise. On February 11, 1994, Executive Order 12898, *A Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations*^a was published in the *Federal Register* (59 FR 7629). The executive order requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations (defined as those living below the poverty level). The executive order makes it clear that its provisions apply fully to Native American populations and Native American tribes, specifically to effects on tribal lands, treaty rights, trust responsibilities, and the health and environment of Native American communities.

Communities within Campbell County, entities with interests in the area, and individuals with ties to the area all may have concerns about the presence of a coal mine within the general analysis area. Communities potentially impacted by the presence or absence of a coal mine are identified in this section of the EIS. Environmental justice concerns are usually directly associated with impacts on the natural and physical environment, but these impacts are likely to be interrelated with social and economic impacts as well. Native American access to cultural and religious sites may fall under the umbrella of environmental justice concerns if the sites are on tribal lands or treaty right has granted access to a specific location.

Compliance with Executive Order 12898 concerning environmental justice was accomplished through opportunities for the public to receive information on this EIS in conjunction with the consultation and coordination described in chapter 5 of this document. This EIS and contributing socioeconomic analysis provide a consideration of impacts with regard to disproportionately adverse impacts on minority and/or low-income groups, including Native Americans.

HAZARDOUS AND SOLID WASTE

Potential sources of hazardous or solid waste on the West Hay Creek LBA tract would include spilling, leaking, or dumping of hazardous substances, petroleum products, and/or solid waste associated with mineral, coal, oil and/or gas exploration and development, or agricultural or livestock activities. No such hazardous or solid wastes are known to be present on the LBA tract. Wastes produced by current mining activities at the Buckskin Mine are handled according to the procedures described in chapter 2.